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A POSSIBLE BL HERCULIS VARIABLE IN CETUS

The Maria Mitchell Observatory is conducting a search for variables in the region of the South Galactic Pole. Blinking pairs of plates revealed one definitive variable. The coordinates are $00^h\ 45^m\ 04^s$, $-18^\circ\ 08'\ 51''$ (1900).

The star appears on approximately 40 plates of the Maria Mitchell collection spanning the years 1980 (when the observatory began photographing the field) to 1984. Using the data from these plates, a Lafler-Kinman (1965) period search was run for the period range .25 day to 10 days. This revealed a period for the variable of 1.137695 $\pm$ .000035 days. The mean error was determined by the method of Belserene (1983). The epoch of maximum is JD2445593.72. The rising branch occupies 0.13 of the cycle.

The range is 13.9 to 14.9, photographic, according to provisional magnitudes for the sequence stars, which are shown in the finding chart, Figure 1. The magnitudes are based on a rather unsatisfactory photographic transfer from photoelectric magnitudes in NGC288, which is 9° to the south.

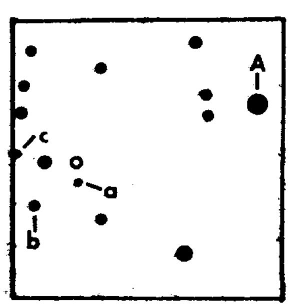

Figure 1. Finding chart, 25' x 25', with north up and east to the left. Star A is SAO 147459. Provisional m_{pg} for a, b, and c are 14.1, 14.7, and 15.4, respectively.

Both the high galactic latitude (-80^{o}) and the large amplitude imply that this may be a variable of the BL Herculis type. Secondary humps, which are characteristic of these short period Population II Cepheids (Kwee 1967) have, however, not been observed.

It would be interesting if observatories with plate archives would study this star for the rapid period changes which are expected in the BL Her stage of evolution. (Christianson 1984, Gingold 1976).

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A FURTHER SEARCH FOR THE δ-Sct-LIKE VARIABILITY OF THE Ap STAR HD 10088

The Ap star HD 10088 (SAO 74848, sp=A0p, m_V=7.9) was reported earlier by Weiss (1983) to show δ Sct-like variability with a period of about 1^h29^m and an amplitude of about $0.^m03$ in Strömgren v.

A search by Kreidl (1984) failed to detect any such variability on three nights separated by many weeks. To see if the reported 1^h29^m period was still absent, an effort was undertaken to obtain additional photometry.

Lowell Observatory's 1.1-m telescope, equipped with a dual-channel photometer utilizing cooled S-11 tubes and B and V filters, was employed. Alternating sets of three 10-second integrations were obtained on HD 10088 and the comparison star, HD 9985 (SAO 74837, m_V=8.0). The observations are summarized in Table I, and the differential data are plotted in Figure 1. The differential data were obtained by subtracting from the observed HD 10088 magnitudes linearly interpolated HD 9985 data.

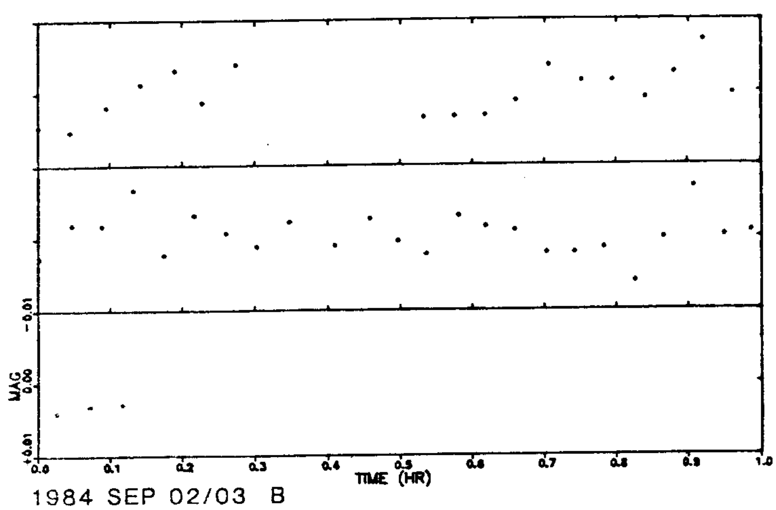
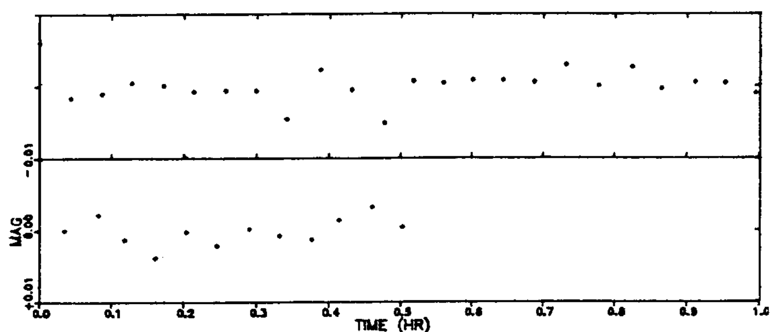
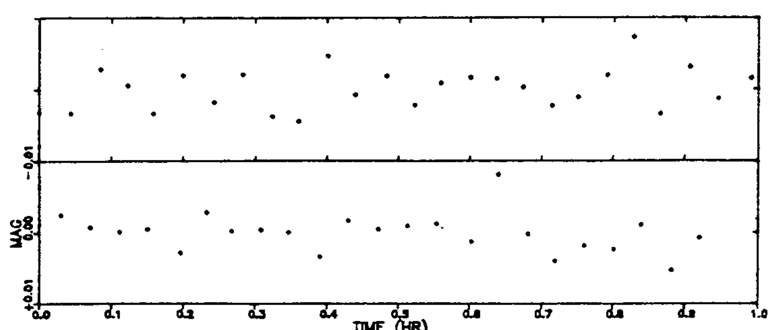


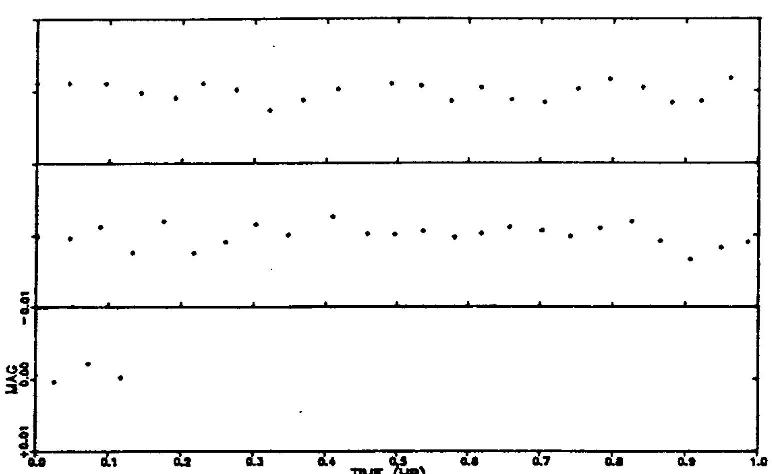
Figure 1. The differential data (HD 10088 - HD 9985), normalized to Δm=0.0. Each panel is one hour wide; the time series progresses left-to-right and top-down. The height of each vertical division is $0.^m01$. The gap in the Sep 02/03 B data was due to a temporary problem with a signal cable.



1984 SEP 03/04 B

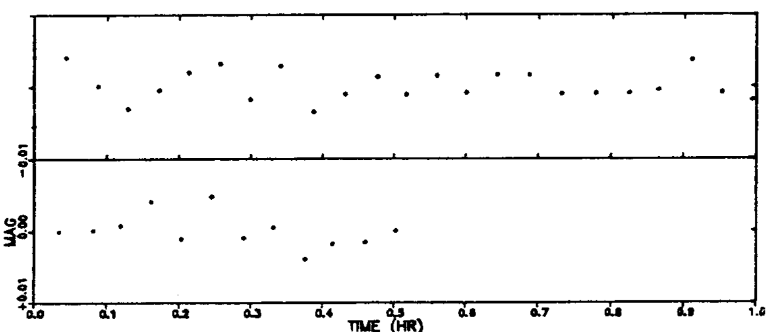


1984 SEP 20/21 B



1984 SEP 02/03 V

Figure 1 (cont.)



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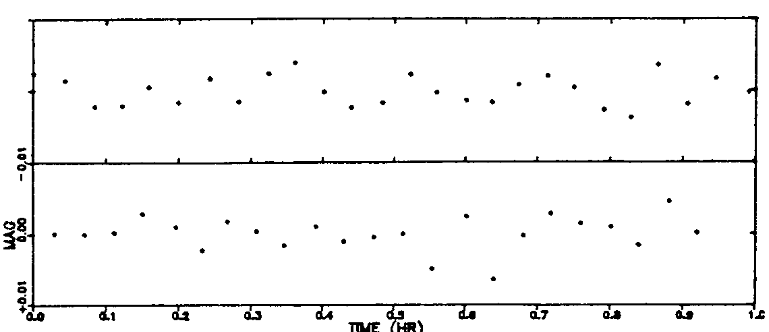

1984 SEP 20/21 V

Figure 1 (cont.)

Table I. Journal of observations of HD 10088 (V) and HD 9985 (C).

Date 1984	t (hours)	σ_B	σ_V	HJD (at start) 2,445,900+	Δm(V-C) (at start) B	V
Sep 02/03	2.12	$0.^m0031$	$0.^m0014$	46.9110	-0.151	-0.072
Sep 03/04	1.50	0. 0023	0. 0021	47.9237	-0.151	-0.073
Sep 20/21	1.93	0. 0028	0. 0022	64.9311	-0.164	-0.072

Again, no evidence is present for low-harmonic pulsation. Combining the data presented in Kreidl (1984) with these, we obtain a total of ~13.5 hours of differential photometry, mainly in two simultaneous channels, on six nights. The chance that a beat phenomenon is responsible for the absence of δ Sct-like pulsation is, therefore, very small. Although the possibility still cannot be ruled out that HD 10088 may pulsate rarely, the present evidence indicates the lack of such low-harmonic pulsation over long periods of time.

If HD 10088 (listed as A0p in the SAO catalog) and the hotter (viz. earlier than ~A5) CP2 stars only show irregular pulsational activity, it speaks against low-harmonic pulsation as being the driving mechanism. Such hot stars should not even lie in the instability strip. Although over a dozen Ap stars have been claimed to show δ Sct-like variability, most have also failed to show such δ Sct-like variability in one or two sets of observations. The only Ap stars in which low-harmonic pulsation seems to be consistently present are HD 3326 (Kurtz 1982), HD 4849 (Weiss 1979, Kurtz 1982) and HD 185139 (Kurtz 1982), and these are all cooler. They have not, however, been monitored extensively.

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SEARCH FOR B-TYPE VARIABLE STARS IN OPEN CLUSTERS

The search for β Cephei stars in open clusters and OB associations can provide valuable information, in order to get a reliable observational definition for this type of variable stars. After the pioneer work of Hill (1967), some astronomers have pointed out the significance of these searches, which have been up to now mostly restricted to clusters in the southern hemisphere. We have started an observational program for northern clusters, which has already produced the first results (Delgado et al., 1984). The clusters listed in the table deserve a particular attention in this respect. They have been selected from the catalogues of Becker and Fenkart (1971), Mermilliod (1976) and Lyngå (1981), according to the following criteria:

- Observable from our latitude (37° N)
- Magnitude of brightest star <10
- Earliest spectral type between O6 and B4
- Included in one of those age groups of Mermilliod (1981), containing clusters with already detected B-type variable members

The second criterium is imposed by our instrumental capabilities. However, a number of clusters large enough can be selected. The table contains the number of the cluster in the NGC or IC catalogues, the coordinates (equinox 1950.0), the youngest spectral type, the magnitude of the brightest member and the logarithm of the age in years. An asterisk indicates that some members of the cluster are confirmed or suspected variables.

Number		Alpha	Delta	ST	m	Log age	Ref.
NGC	457	01 15.9	+58 04	B1	6	7.40	
	581	01 29.9	+60 27	B2	9	7.35	
	637	01 39.4	+63 55	B0	8		
	654	01 40.6	+61 38	B0	10	7.18	
	663	01 42.6	+61 00	B0	9	7.35	
	869(*)	02 15.5	+56 55	B0	7	6.75	1,2,3
	884(*)	02 18.9	+56 53	B0	7	6.50	1,2,3
	1502(*)	04 03.3	+62 12	B0	7	7.30	1
	1960	05 32.8	+34 06	B3	9	7.40	
	2169(*)	06 05.6	+13 58	B1	7	7.70	1
	2244	06 29.7	+04 54	O5	7	6.48	
	2264	06 38.3	+09 56	O8	5	7.30	
	6823	19 41.0	+23 11	O7	9	6.30	
	6830	19 48.9	+22 56	B0	10	8.0	
	6871(*)	20 04.0	+35 58	O6	7	7.0	4
	6883	20 09.4	+35 42	B3	8	7.17	
	6910	20 21.3	+40 37	B0	7	7.0	
	6913	20 22.1	+38 22	B0	9	7.0	
	7160(*)	21 52.3	+62 22	B2	7	7.0	1
	7235	22 10.8	+57 02	B0	9	6.3	
	7380	22 45.0	+57 50	O9	10	6.58	
	7510	23 09.4	+60 18	O9	10	7.0	
	7788	23 54.2	+61 07	B1	10	7.2	
	7790	23 55.9	+60 56	B4	10	7.82	
IC	1805	02 28.9	+61 14	O6	9	6.12	
	4996(*)	20 14.6	+37 29	B0	8	7.0	5

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2.- J.R. Percy, 1972: Pub. Astron. Soc. Pacific, 84, 420

3.- R. Garrido and A.J. Delgado, 1982: IBVS, No.2080

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In our opinion, the systematic performance of such observations should clarify two main problems related to β Cephei stars:

1/ Precise determination of the zone in the HR diagram, in which B-type variable stars are found. This obviously leads to the knowledge of the evolutionary status of the β Cephei stars and to defining the limits of the instability strip or box, if any.

2/ Possibility of establishing a period - luminosity or period - luminosity - colour relation for stars of the same age and chemical composition and of testing the possible dependence of this relation on the parameters of the cluster.

As mentioned before, we are presently carrying out observations on the clusters listed in the Table. Any information concerning the member stars of these clusters should be acknowledged by the authors.

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HD 91816: A NEW BY DRACONIS STAR

An article by Bidelman (1981) noted that the star HD 91816 (SAO 156090, BD -11°2916), of spectral type dK0, showed slightly fuzzy absorption lines on objective prism spectra of dispersion 108 Å mm^{-1}. Causes of this might include rapid rotation or unresolved double lines in a spectroscopic binary. Either way, the late spectral type and rapid rotation suggested that HD 91816 should be chromospherically active, and the star was added to our photometric and spectroscopic monitoring programs at Cloudcroft, McDonald and Kitt Peak Observatories. In this note we report the detection of low amplitude photometric variability in HD 91816 with a period of 3.1448 days. This variation is presumably due to the presence of starspots in a syncronously rotating double-line spectroscopic binary (SB2) of about the same period. HD 91816 is thus a new BY Draconis variable.

Photometry was obtained in the UBV bandpasses with the 48-inch telescope at Cloudcroft Observatory, the 30- and 36-inch telescopes at McDonald Observatory, and the #2 36-inch telescope at Kitt Peak National Observatory (KPNO). The Cloudcroft and McDonald measures used SAO 156079 as the comparison, and the differential magnitudes are presented in Table 1. The measures are in the same variable minus comparison, and have been corrected for differential extinction and transformed differentially to the UBV system. Before JD 2445150 the photometry was obtained at Cloudcroft; after that date it was obtained at McDonald.

TABLE I

Cloudcroft and McDonald Photometry of HD 91816

JD(Hel.)	ΔV	ΔB	ΔU
2445106.680	-1.114	-1.424	--
107.637	-1.115	-1.423	--
116.633	-1.115	-1.415	--
118.644	-1.116	--	--
119.632	-1.109	--	--
120.647	-1.119	--	--
121.652	-1.125	--	--
128.638	-1.119	--	--
130.639	-1.127	--	--
137.641	-1.127	--	--
138.648	-1.110	--	--
145.634	-1.126	--	--
320.948	-1.109	-1.397	-2.040
337.875	-1.117	-1.425	-2.043
368.917	-1.126	-1.439	-2.051
372.812	-1.134	-1.443	-2.064
2445394.758	-1.134	-1.444	-2.071

TABLE II

Kitt Peak Photometry of HD 91816

J.D.(Hel.)	V	(B-V)	(U-B)
2445330.989	8.052	0.851	0.505
424.693	8.046	0.849	0.518
485.651	8.048	0.867	0.479
683.970	8.048	0.853	0.513
684.934	8.035	0.850	0.505
723.962	8.051	0.845	0.513
724.924	8.043	0.848	0.506
725.966	8.027	0.851	0.491
778.763	8.036	0.854	0.499
2445779.773	8.028	0.854	0.499

The data were examined for periodicity using several algorithms, and the best fit was found at P = 3.1448 days. The light curve is plotted using this period in Figure 1, where zero phase is taken arbitrarily as JD 2445106.680. This small range of variability might make the period suspect, were it not for the independent set of photometry from KPNO, which confirms this period.

The KPNO photometry used SAO 156086 as comparison, for which the following magnitudes and colors were obtained:

$V = 7.583 \pm 0.007$, $(B-V) = 1.024 \pm 0.002$, $(U-B) = 0.853 \pm 0.005$

The differential magnitudes and colors were transformed to the UBV system using the matrix inversion method described by Harris, Fitzgerald, and Reed (1981). These data are presented in Table II. Period analysis of the KPNO data, which partially overlap the McDonald data in time, showed the same period of 3.1448 days; we plot the KPNO data, using the same period and epoch, in Figure 2. There may be a small phase shift between the two data sets, though the amplitude appears unchanged.

The most recent photometry was obtained on three nights in April 1984, with the 14-inch telescope at Barksdale's observatory. Nightly means are

JD (hel.) = 2445791.680	$\Delta V = -1^{m}_{\cdot}102 \pm 0^{m}_{\cdot}006$
= 2445792.605	$= -1.090 \pm 0.005$
= 2445797.648	$= -1.120 \pm 0.007$,

where Δ is in the sense HD 91816 minus SAO 156079, the same comparison star used at Cloudcroft and McDonald. The brightest and faintest measures reflect the full amplitude found previously. Moreover, when phases are computed with the same ephemeris, the faintest point (at $0^{p}_{\cdot}12$) falls near minimum in Figure 1 and the brightest point (at $0^{p}_{\cdot}72$) falls near maximum.

We obtained two CCD scans of the Hα region of HD 91816 using the coudé feed telescope at KPNO. A scan obtained on 5 April 1982 UT shows double absorption lines of approximately equal intensity; the velocity separation

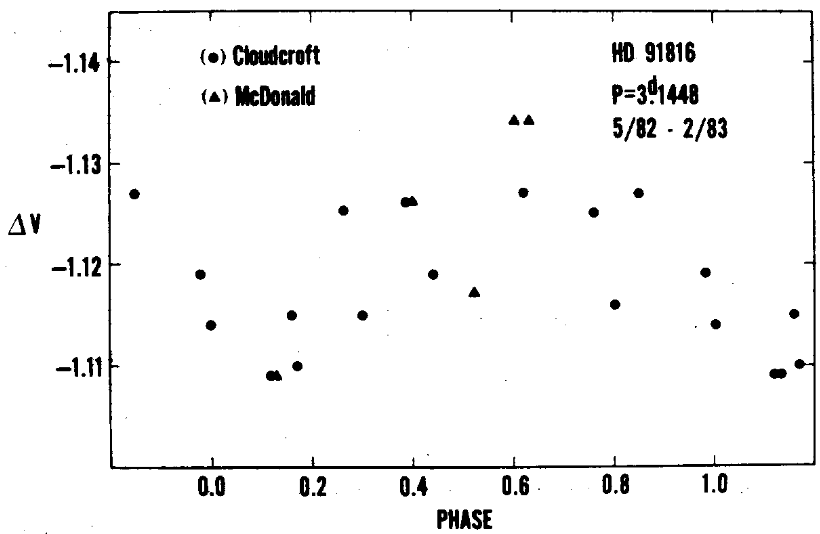

Figure 1

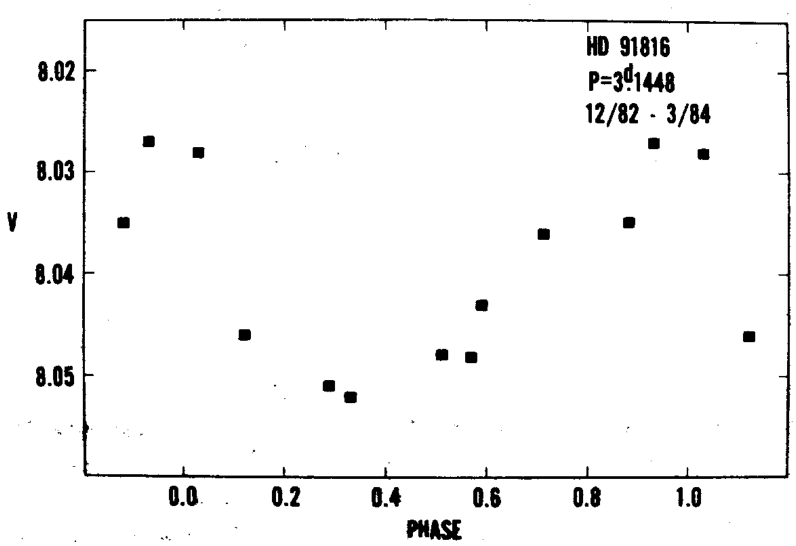

Figure 2

is about 100 km s^{-1}. The other scan, obtained on 27 March 1983 UT, shows single lines. Hα does not appear to be affected by emission on either scan.

In summary, HD 91816 is a dK0 star that is an SB2 and shows small brightness variations with a period of 3.1448 days. The star is a BY Dra variable (Bopp and Fekel 1977), with the photometric period representing the rotation period of the stars. It is likely that the rapid rotation suggested by the photometric period is the result of synchronism in this SB2. (The equatorial rotation velocity of a K0 dwarf with R = 0.85 $R_\odot$ and a three day rotation period is about 15 km s^{-1}). If this is the case, then an orbital period very near 3.1 days is expected.

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ADDITIONAL PHOTOMETRY OF THE Of-TYPE VARIABLE HD 167971

Leitherer et al. (1984) have recently reported the detection of variability in the O8Ib(f) star HD 167971, the brightest member of the young open cluster NGC 6604 and one of the visually most luminous stars in the Galaxy (Humphreys 1978). The purpose of this note is to present additional UBV photometry of HD 167971 which confirms the results of Leitherer et al. for this very massive star.

HD 167971 was observed on 4 nights in March and April 1984 as part of a study of NGC 6604 and the surrounding Serpens OB2 association. The photometry was done with the 0.6m telescope of the University of Toronto at Las Campanas, using a 1P21 photomultiplier cooled with dry ice, and standard Johnson UBV filters. The mean errors of the photometry are estimated to be ± 0.01 in V and B-V, and ± 0.02 in U-B. Subsequent to Leitherer et al.'s announcement, additional UBV data were obtained on 7 nights in August 1984 using the 1.3m and #1, 0.9m telescopes of Kitt Peak National Observatory (KPNO). Both telescopes were equipped with a 1P21 photomultiplier cooled with dry ice, and a standard KPNO UBV filter set which included a blocked ($CuSO_4$) U filter. The mean errors of the KPNO photometry are ± 0.01 in V and ± 0.02 in B-V and U-B. The results of the Las Campanas and KPNO photometry are given in Table I and illustrated in Figure 1.

The mean magnitude and colours (and their standard deviations) based on all 13 observations are:

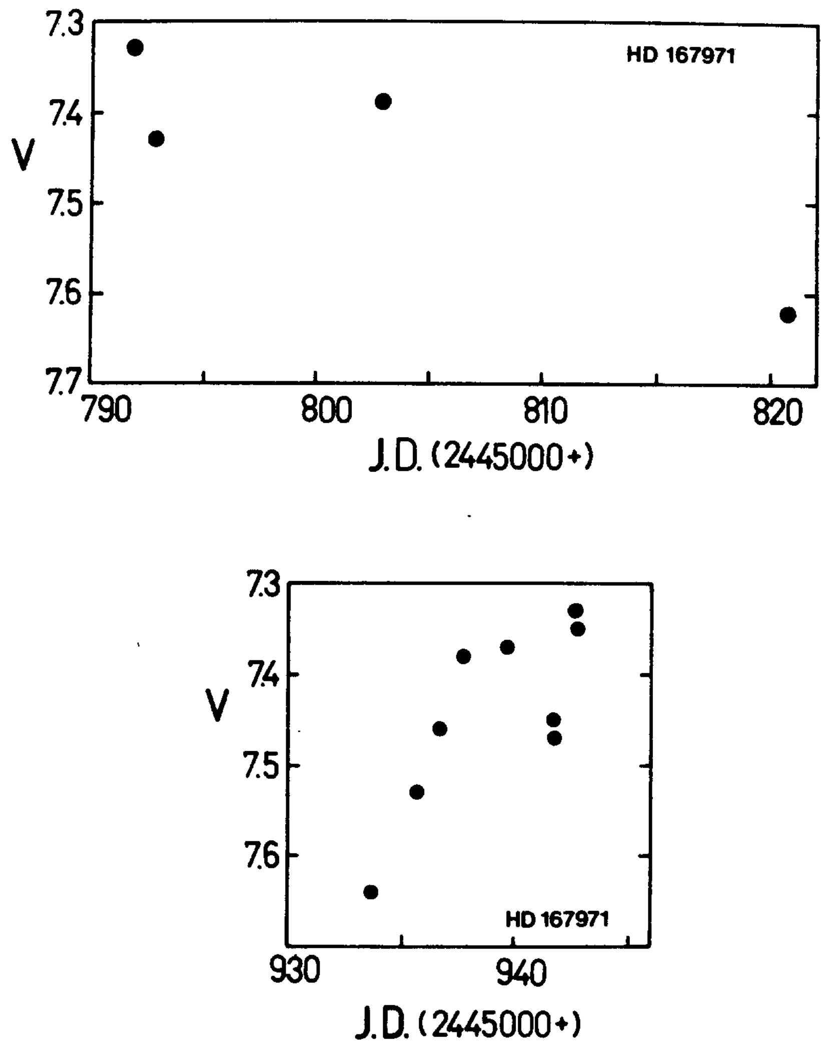

Figure 1: Photoelectric V magnitudes of HD 167971 between JD 2445790 and JD 2445945.

$$\langle V\rangle = 7.442 \pm 0.102$$

$$\langle B-V\rangle = 0.750 \pm 0.017 \qquad (n = 13)$$

$$\langle U-B\rangle = -0.348 \pm 0.015$$

Table I

UBV Photometry of HD 167971

J.D.	V	B-V	U-B
2445791.872	7.33	0.75	-0.34
5792.840	7.43	0.78	-0.33
5802.844	7.39	0.75	-0.34
5820.761	7.62	0.77	-0.33
5933.685	7.64	0.77	-0.35
5935.688	7.53	0.76	-0.34
5936.673	7.46	0.75	-0.33
5937.708	7.38	0.74	-0.37
5939.677	7.37	0.73	-0.36
5941.656	7.45	0.74	-0.36
5941.708	7.47	0.74	-0.36
5942.637	7.33	0.72	-0.37
5942.691	7.35	0.75	-0.35

It is apparent from the data that HD 167971 is variable, with an amplitude of $\sim 0\overset{\mathrm{m}}{.}3$, as was first found by Leitherer et al. The mean colours given above differ slightly from those derived by Leitherer et al., presumably as a result of the different photomultiplier/filter combinations used. There is some indication that the star becomes slightly bluer in both B-V and U-B as it brightens in V, but the amplitude of the colour variation ($\sim 0\overset{\mathrm{m}}{.}04$) is within the photometric uncertainty.

A check on the reality of the variability of HD 167971 can be made using observations of the nearby ($\lesssim$ 45 arcsec) star BD-12°4981 (BOV; star "2" of Moffat and Vogt 1975). This star, also a member of NGC 6604, was observed on 10 of the 13 nights listed in Table I, usually just before or after the HD 167971 observation. The mean magnitude and colours for BD-12°4981 are:

$$\langle V\rangle = 10.151 \pm 0.014$$
$$\langle B-V\rangle = 0.612 \pm 0.024 \qquad (n = 10)$$
$$\langle U-B\rangle = -0.433 \pm 0.019$$

where the errors quoted are standard deviations of the mean. It is clear that the variability noted for HD 167971 is intrinsic to the star and not the result of extraneous effects. The significant differences between the present photometry and that of Moffat and Vogt (1975) for BD-12°4981 (and, to a lesser degree, for HD 167971) suggest possible systematic errors in Moffat and Vogt's photometry for stars in NGC 6604. This possibility is being investigated as part of the study of NGC 6604 and Ser OB2 now being made.

As Leitherer et al. point out, there had been no indication of photometric variability of HD 167971 prior to their announcement. It is of interest to note, however, that there exists in the literature some evidence for spectrum variations. Walborn (1972) classified the star as O8Ib(f) (a classification that has been generally adopted), and noted the lack of a feature at λ 4686, but the presence of a weak, narrow emission line $\sim$ 10 Å to the blue of that wavelength. Fitzgerald et al. (1979) however give a classification of "O9I(var?)", based on two 74 Å mm^{-1} spectrograms obtained at the 1.5m telescope at the European Southern Observatory. There appear to be no other indications of spectrum variability among the several other spectral classifications that exist for the star (all of which agree quite well with one another). Hβ photometry by Moffat and Vogt (1975) and by Crawford (1975) gives β = 2.517 and β = 2.553, respectively, suggesting possible changes in the strength of the Hβ line. Additional Hβ photometry would be needed to confirm this possibility. The mean of two photographic Hγ measures by R.M. Petrie (Crampton et al. 1973) is W_γ = 1.7, which does not appear to be abnormal for the spectral type (Balona and Crampton 1974).

An attempt was made to detect a periodicity in the photometry of Leitherer et al. and this paper combined, but without success. It is evident from the combined data that variations are occurring on a time scale of ∿ 1 day, and perhaps as short a time as a few hours. It is hoped that further photometric and spectroscopic observations will allow the cause of the variations in HD 167971 to be determined, and will lead to a better understanding of such very luminous, massive stars.

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H_α EMISSION IN RS CVn STARS: HD 8357, HD 175 742 AND HR 7428

Recently Hall et al. (1984) edited the "Hall Catalogue of RS CVn Binary Systems", in which twenty stars with H_α emission were reported. We observed 33 RS CVn stars in the H_α region using the coudé Reticon system of the McDonald Observatory 2.1 m telescope. The dispersion is 9.5 Å/mm and the resolution is 0.29 Å. Three of these stars (HD 8357, HD 175 742 and HR 7428) showed conspicuous H_α emission. Physical data and observational details are listed in Table I. The individual systems are reported separately below.

Table I

star	sp	mag.	period	obs. J.D.(H)	phase
HD 8357	G5 composite	7.28	-	2445957.8848	-
				57.9428	-
				58.8243	-
				58.9799	-
				59.8129	-
				60.9638	-
HD 175 742	K0V K5 - M2V	8.4	-	2445958.6146	-
				58.6764	-
				59.6153	-
				60.5845	-
HR 7428	A? K2 III-II	6.36	108.6	2445957.6288	0.4835
				58.5794	0.4922
				59.5774	0.5014
				59.6711	0.5023
				60.5669	0.5106

HD 8357:

The H_α profile changed significantly in both emission and absorption components as shown in Figure 1. The peak of emission fluctuated somewhat but was systematically shifted to the blue from the expected photospheric velocity by 0.6 Å. The intensity of the strongest emission is 1.29 times of that of the continuum. The profile is similar to that of UX Ari. (Nations and Ramsey, 1980).

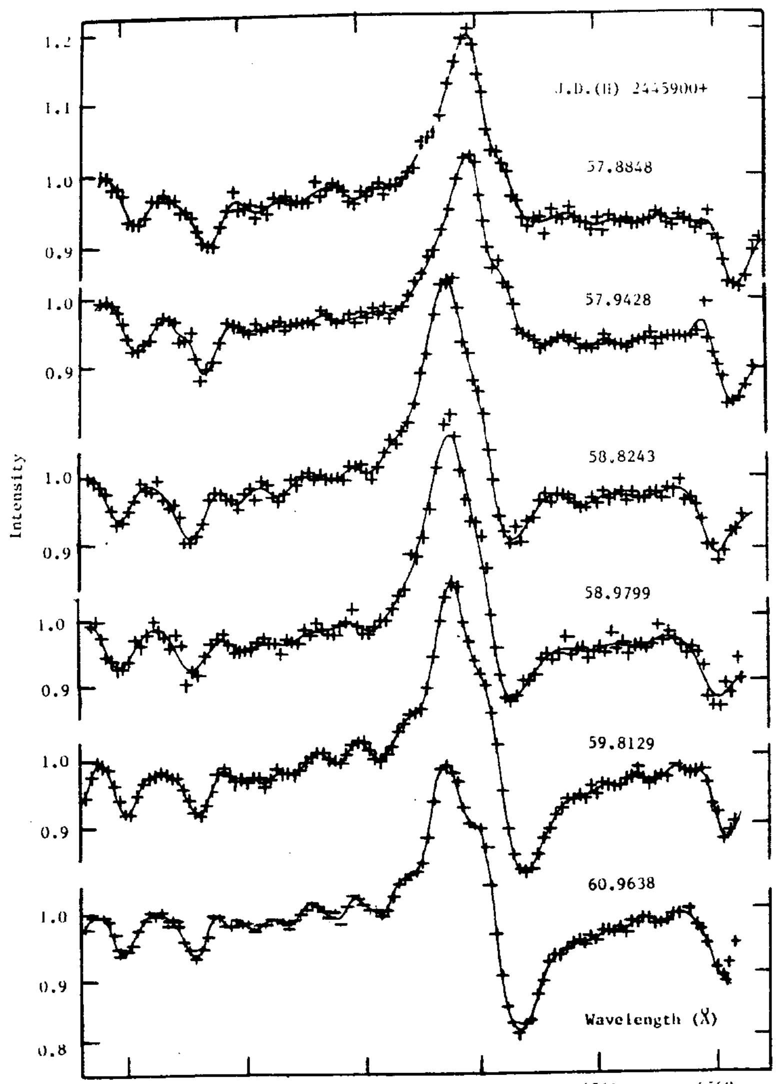

Figure 1. Variation of the H_α emission feature of HD 8357

HD 175 742:

These H_α profiles are bizarre, and show extreme changes over three nights (Figure 2). The interval between the two observations on Sep. 15 was only 1.5 hours, but the two profiles are radically different, and the emission peak shifted from red to blue. The period of variation will be very short if the change is periodic.

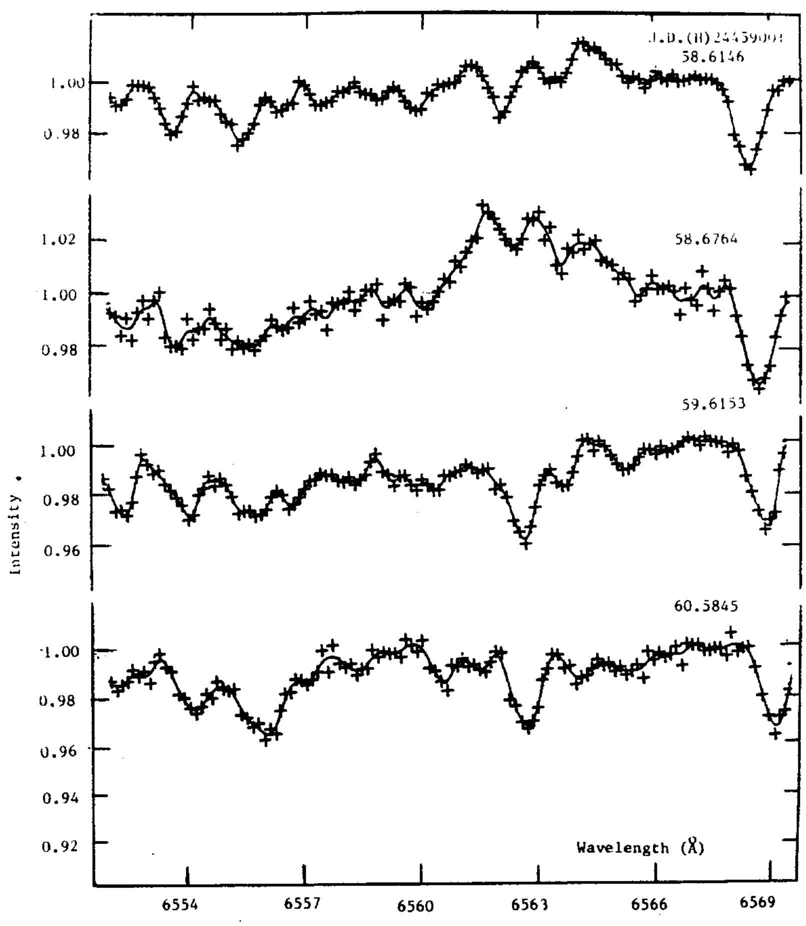

Figure 2. Variation of the H_α emission of HD 175 742

HR 7428 :

HR 7428 shows double emission, the red element being stronger than the blue one as shown in Figure 3, in which we only drew one plot since the profiles show little change in blue emission. This star was observed by Bopp et al. (1978), but they did not find H_α emission from two plates. Our observations were near phase 0.5. The H_α emission may be related to the phase, so more observations are needed.

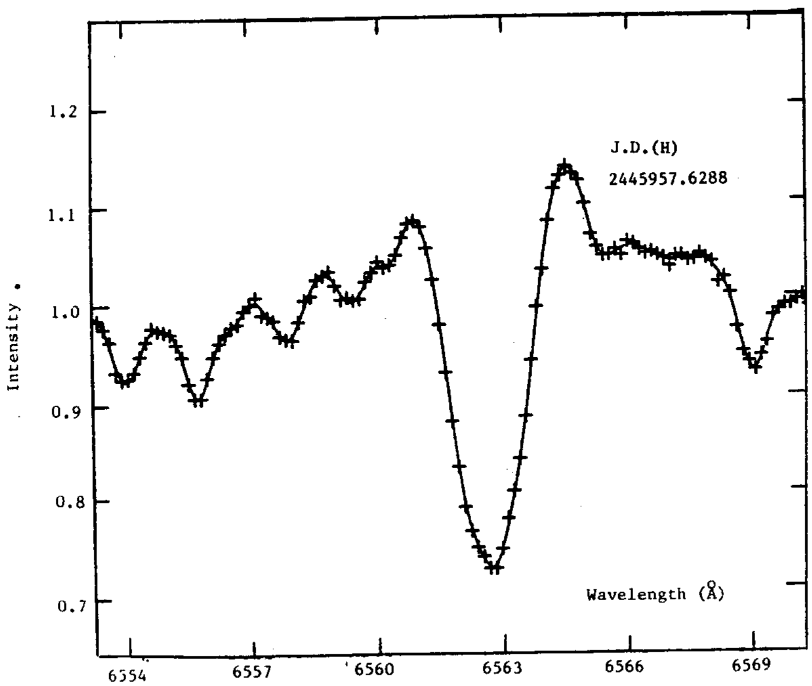

Figure 3. H_α emission feature of HR 7428

We are especially grateful to Dr. H. Smith for scheduling the telescope time.

LIU XUEFU and TAN HUISONG

McDonald Observatory
The University of Texas
(two visiting scholars from China)

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A SEARCH FOR LOW-HARMONIC PULSATION IN THE Ap STAR HD 184 905

The Ap star HD 184905 (SAO 48604, m_V=6.48, sp=A0p SiCrSrEu) was reported by Panov (1981) to show short-period light variations with a period of about 25-30 minutes and an amplitude of about $\pm0.^m01$ in U,B,V on several nights. Consequently, this star has been included in an observing program by the author to investigate the presence of short-period variations in Ap stars over long periods of time.

Differential photometry was obtained using HD 184875 (HR 7444, SAO 48601, m_V=5.35, sp=A2V) as a comparison star on the Lowell 1.1-m telescope. A dual-channel photometer utilizing cooled S-11 tubes and B and V filters was employed. Alternating sets of three 10-second integrations were obtained on HD 184905 and HD 184875. The observations are summarized in Table I. The differential magnitudes, normalized to zero, are plotted in Fig. 1.

Table I. Journal of observations of HD 184905 (V) and HD 184875 (C).

Date 1984	t (hours)	σ_B	σV	HJD (at start) 2,445,900+	Δm(V-C) (at start) B	V
Aug 30/31	0.52	$0.^m0021$	$0.^m0037$	43.7074	1.195	1.288
Sep 27/28	2.86	0. 0014	0. 0024	71.6662	1.205	1.300
Sep 28/29	2.93	0. 0014	0. 0024	72.6659	1.180	1.266

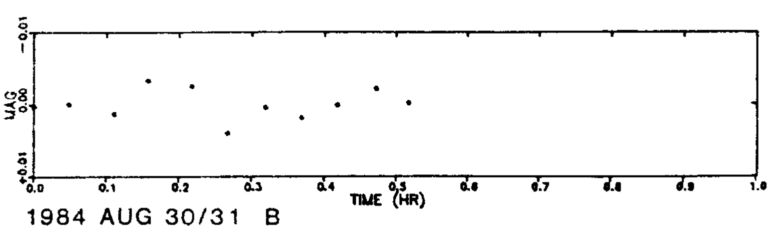
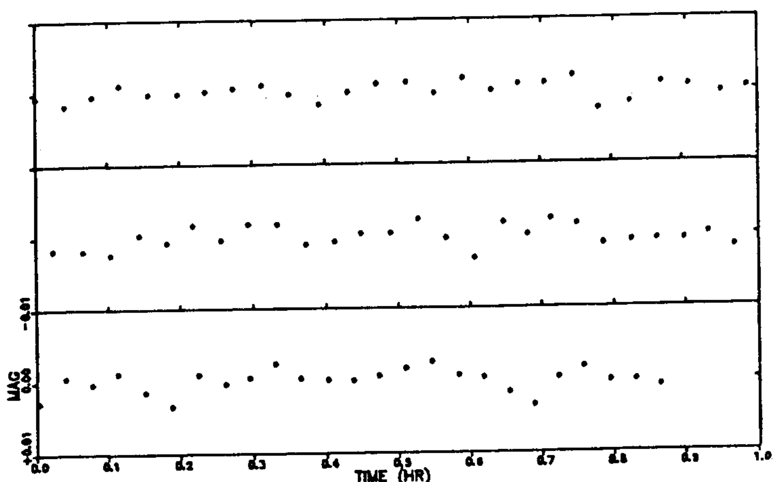
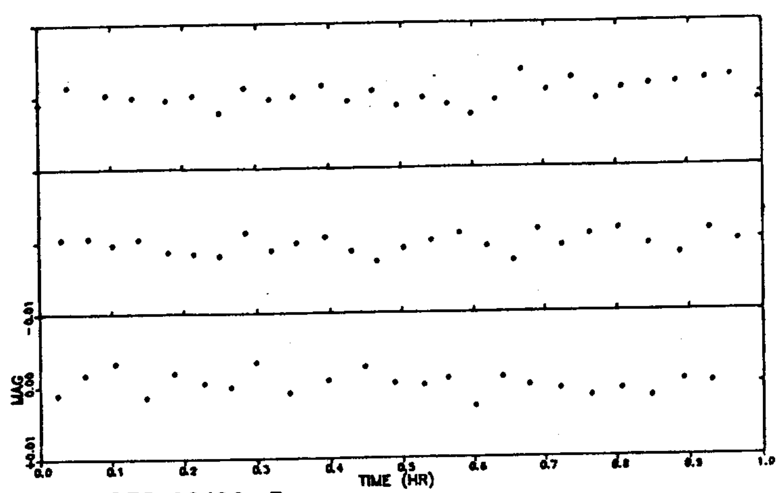


Figure 1. The differential data (HD 184905 - HD 184875), normalized to Δm=0.0. Each panel is one hour wide; the time series progresses left-to-right and top-down. The height of each vertical division is $0.^m01$.

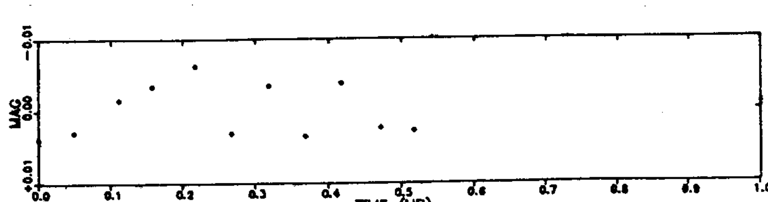
Fig. 1 (cont.)



1984 SEP 27/28 B

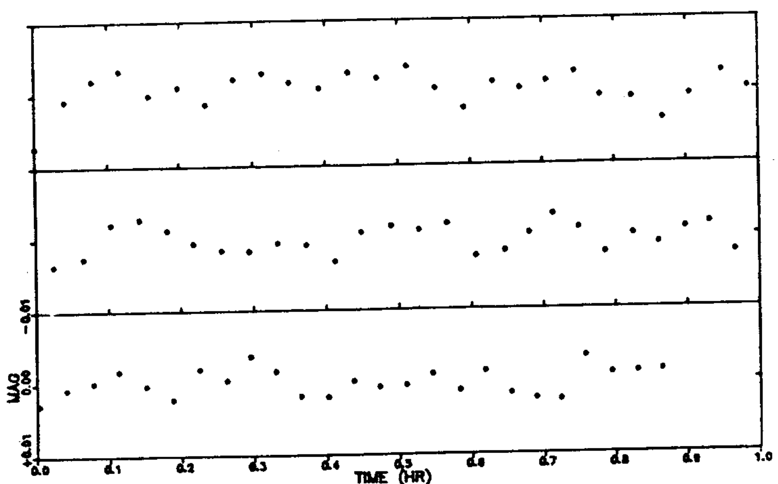


1984 SEP 28/29 B

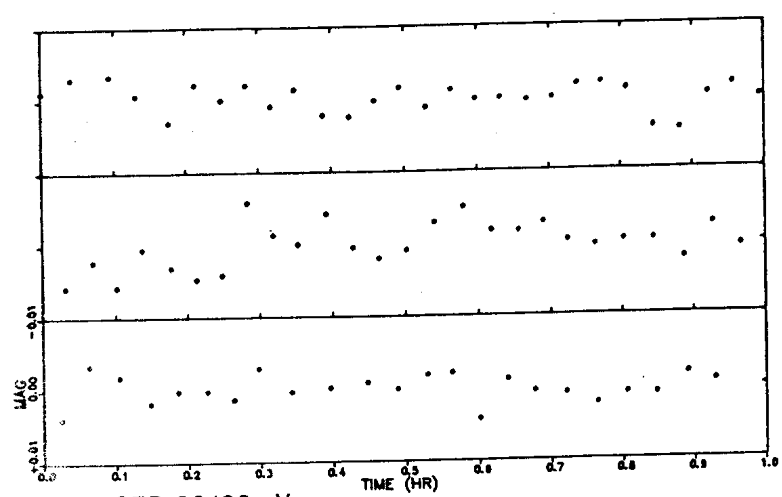


1984 AUG 30/31 V

Fig. 1 (cont.)

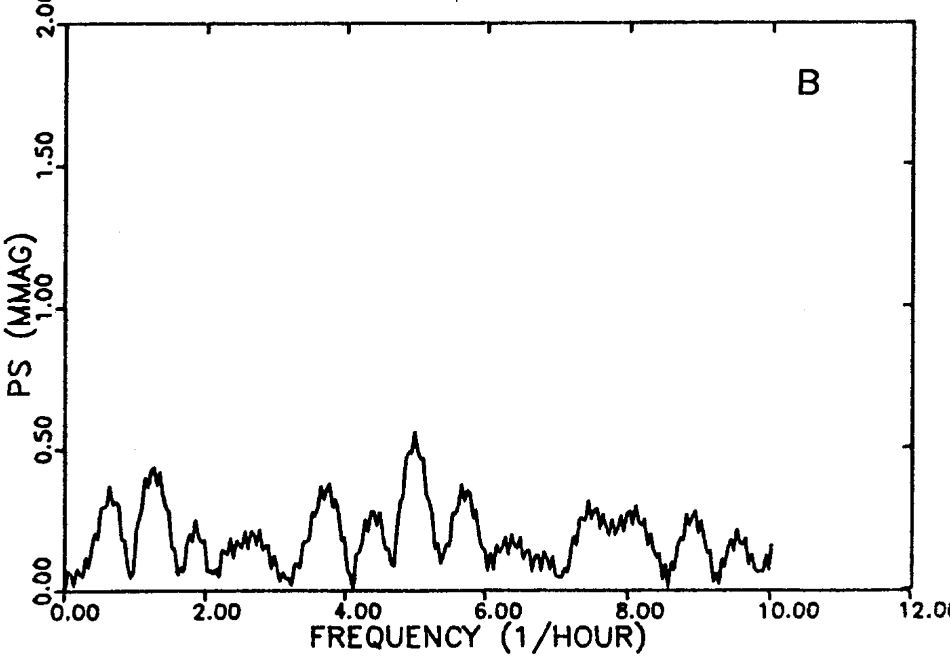


1984 SEP 27/28 V



1984 SEP 28/29 V

No evidence is present for low-harmonic pulsation in the period range 25-30 minutes, nor in the valid range of periods being investigated (approx. 6 to 90 minutes), as demonstrated in Fig. 2. The maximum semi-amplitude is 0.56 mmag in B and 1.02 mmag in V at the period ~12 minutes; the average power lies at about half of these values. While there is a peak in the power spectra at the frequency corresponding to a period of about 12 minutes, it is probably not significant. Rapid oscillations leading to such a period would yield a larger amplitude in B than in V, which is not the case with these data. Consequently,



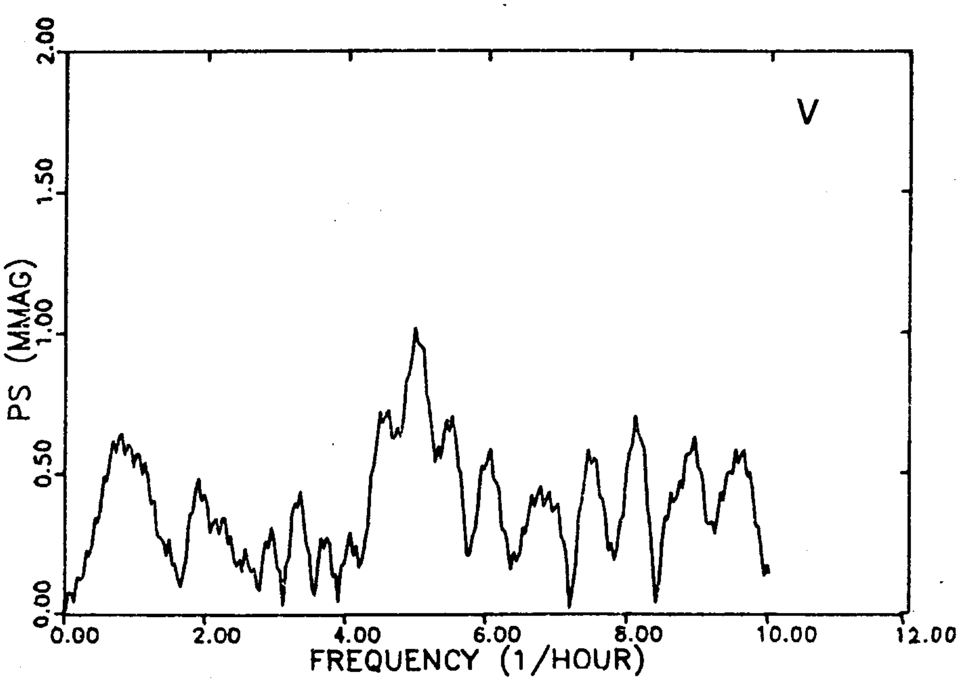


Figure 2. Power spectra for the B and V data presented in Fig. 1.

we are most likely dealing with an artifact. A much higher sampling rate (e.g., 20 seconds) would be required to accurately search for such short periods, since the mean sampling rate here is about 2.5 to 3 minutes.

Investigations by the author have failed to detect any of the reported rapid light variations in the stars HD 10088 (Kreidl 1984a, 1984c), HD 32633 (Kreidl 1984b), HD 125248 (Kreidl 1984d), and HD 184905 (this paper). As in the other cases, HD 184905 appears to be too hot to lie in the instability strip.

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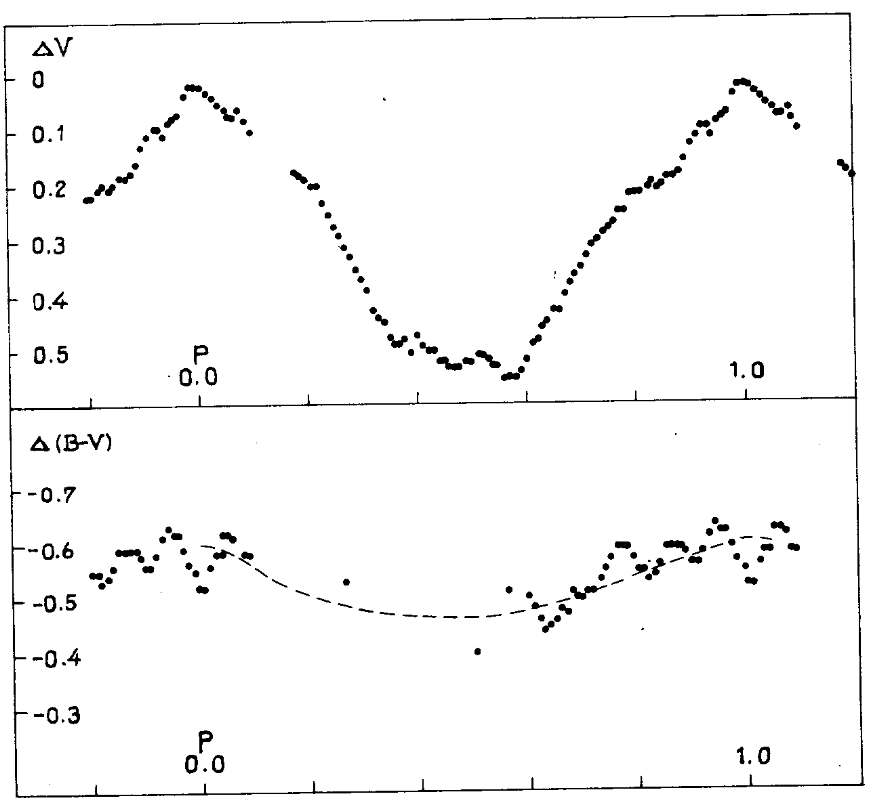
PERIOD AND LIGHT CURVE OF THE RRc STAR VZ VIRGINIS

The variability of this star was detected in 1927 by Belyavsky, but no further investigations have followed.

In a search for blue objects in high galactic latitudes Bond and Tifft (1974) found the spectral type of VZ Vir to be B8 hb (horizontal branch).

Since February 1983 I have observed VZ Vir photoelectrically in B and V with the 60 cm reflector II of Sonneberg Observatory. The conditions for



these observations were never very good because of the low declination of this object. The mean error in one night was about 0.05 to 0.1 mag.

In 1983 a preliminary period of VZ Vir was derived (Luthardt, 1983). By using the observations of 1984 the elements could be improved. A calibration in magnitude of the comparison star has not been made yet.

Elements of VZ Vir: Max. = J.D.hel. 244 5388.651 + $0^d.3396113 \times E$

Amplitude: $A_V = 0.55$ mag

Range of B-V: $\Delta(B-V) = 0.20$ mag $\pm$ 0.05 mag

These elements and the form of the light curve - nearly symmetrical, a small hump on the ascending branch - let us expect an RRc star. For constructing the light curve given in the Figure moving averages are used.

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A NEW VARIABLE STAR (No. 218) NEAR THE GLOBULAR CLUSTER NGC 6401 *

Recent collaboration with W. and A. Wehlau (University of Western Ontario), to determine the periods of some of the 217 variable stars previously identified in and around the globular cluster NGC 6401 (Terzan and Rutily, 1971, 1973) led me to make further photometric measurements of the 52 R plates (Eastman Kodak 103 aE + Ilford filter 204, $\lambda_{eff} \simeq 6500$ Å) which I had obtained from 1968 to 1977 at the Newtonian foci of the 80 and 193 cm telescopes of the Observatoire de Haute-Provence. Results on the periods found will be published in the near future.

However, in the course of those photometric measurements (using the iris-diaphragm photometer Sartorius), I found a new variable, the 218th, which was previously unknown (Kholopoy, 1983). Its equatorial and galactic coordinates for the equinox 1950.0 are :

$\alpha = 17^h\ 36^m.89$ $\qquad$ $l = 3°.49$

$\delta = -24°01'.84$ $\qquad$ $b = 3°.64$

This star is located about 20' southeast of the cluster NGC 6401 (Figure 1), which places it outside the field of the plates taken with 193 cm telescope. It is, however, clearly visible on Palomar Observatory Sky Survey charts, 0-172 and E-172. Since the plates for these charts were taken on the same night, they have been used to estimate the color index, $CI_{B-R} \geqslant 3$ mag.

* based on observations collected at the Observatoire de Haute-Provence and Observatoire de Calern

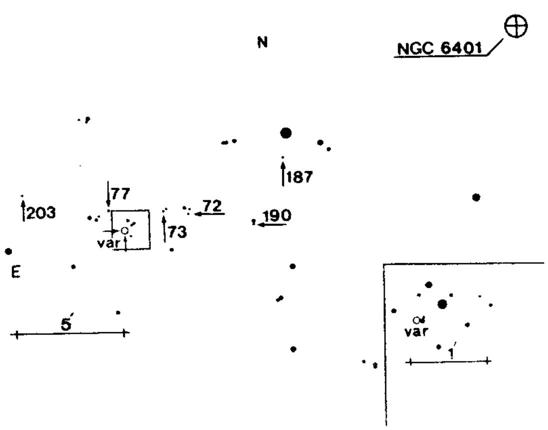

Figure 1. Finding chart (in R) for the variable star No. 218

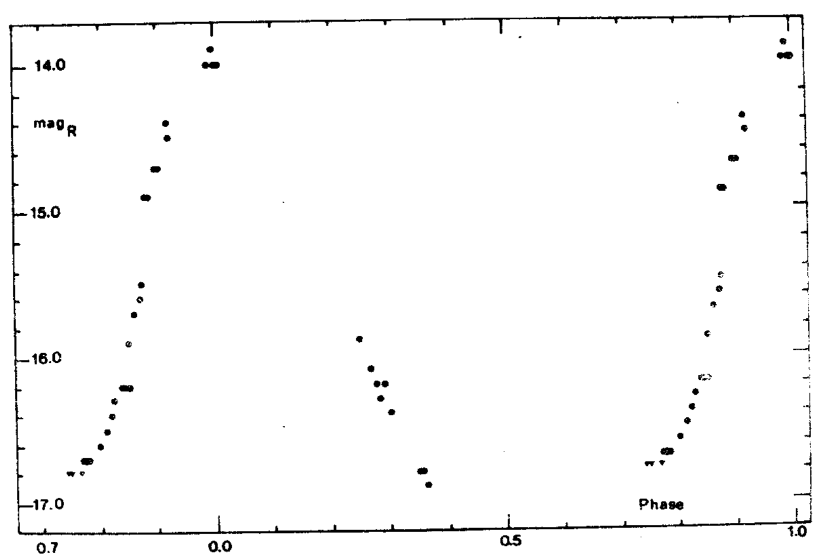

Figure 2. Light curve for the variable star No. 218

Table I

Observations Number	Plate No	J.D. (+2 439 500.00)	m_R
1	1320	471.55	16.8
2	1329	472.58	16.8
3	1341	476.53	16.8
4	1345	477.52	16.7
5	1346	478.55	16.7
6	1347	478.58	16.7
7	1350	479.59	16.7
8	1572	1205.57	16.8
9	1582	1206.57	16.8
10	1592	1208.58	16.9
11	1740	1590.55	15.9
12	1744	1594.61	16.1
13	1751	1596.62	16.2
14	1754	1597.50	16.3
15	1756	1599.55	16.2
16	1773	1601.57	16.4
17	1875	1944.61	14.0
18	1883	1945.64	13.9
19	1891	1946.60	14.0
20	1919	1951.58	14.0
21	1978	2329.48	14.9
22	1981	2329.57	14.9
23	1987	2332.49	14.7
24	1990	2332.58	14.7
25	2002	2336.49	14.4
26	2290	2720.50	16.6
27	2573	3745.63	15.9
28	2588	3747.62	15.7
29	2596	3748.62	15.6
30	2605	3749.61	15.5
31	2644	3759.62	14.5
32	CE 1072	6379.49	16.5
33	CE 1077	6380.51	16.4
34	CE 1085	6381.48	16.3
35	CE 1088	6384.45	16.2
36	CE 1092	6385.38	16.2
37	CE 1096	6385.51	16.2

The light curve shown in Figure 2 was derived from measurements of 31 good plates taken with the 80 cm telescope and from 6 plates obtained this summer with the CALERN/Schmidt telescope (INAG - CERGA). The values of mag_R with the corresponding Julian dates are given in Table I. The prefix CE (CERGA) in front of the numbers of the last six plates indicates their origin.

The amplitude, $A \geqslant 2.9$ mag_R, suggests that this star is a long period variable with epochs of maximum given by :

$$T_{max} = 2,439,618 + \underset{\pm 0.1}{203.2}\ E$$

While the period is well determined, it is difficult to estimate the accuracy of the epoch of maximum light because of the lack of points on the light curve between 0.6 and 0.8.

The interstellar absorption in V and B to the cluster NGC 6401 may be estimated using

$$A_V = 3E_{B-V} \qquad \text{and} \qquad A_B = 4E_{B-V}$$

with the following values :

Woltjer, 1975	$E_{B-V} = 0.5$	a relatively low value	
Bernard, 1976	$E_{B-V} = 0.85$	$A_V = 2.55$ mag	$A_B = 3.4$ mag
Harris, 1976	$E_{B-V} = 0.79$	$A_V = 2.47$ mag	$A_B = 3.16$ mag

So, adopting $\overline{A}_B = 3.25$ mag (a value comparable to $\overline{A}_{pg}$ 5.5 mag, Terzan, 1965, in front of the bright cloud B of Sagittarius, in the direction of the star 45 Oph, which is one of the most observed zones in B) one could derive the spectral type of the star and use it as an argument to test our hypothesis that star No. 218 is a long period variable if the colour index (B-V) were available.

Consequently, in the near future, I plan to establish B and V magnitude sequences ($mag_B \simeq 20, mag_V \simeq 19$) in the field of the globular cluster NGC 6401 and to determine the B - V color of this variable, taking into account the interstellar absorption in this direction towards the center of our galaxy.

I express my thanks to Mr. and Mrs. A. Wehlau for discussion of this work.

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RECENT CHANGES IN THE SPECTRUM OF CH CYG

Spectroscopic observations of CH Cyg have been carried out by many astronomers and are widely discussed in papers since the 1977 outburst. The reason for that is that the star shows the longest period of its high activity with characteristic increase in brightness and with appearance of spectral features like those in symbiotic stars.

In December, 1979 regular observations of CH Cyg were started using the coude spectrograph of the 2 m telescope at the National Astronomical Observatory (NAO) of the Bulgarian Academy of Sciences. The observations cover the spectral range from 3500 A to 9000A with dispersion 4 and 9 A/mm in the blue and 18 A/mm in the red and infrared region. Some of the results have been published already (Luud et al., 1982 and Tomov and Luud, 1984).

Recently, however, the star has shown significant changes in its radiation. From the end of July till the middle of August 1984 its brightness decreased. It was $V = 6^{m}.58$, $B-V = +0^{m}.45$ and $U-B = -0^{m}.94$ on August 1, and $V = 6^{m}.82$, $B-V = +0^{m}.48$ and $U-B = -0^{m}.98$ on August 14, 1984 (Luud, 1984).

Comparing the spectra obtained at NAO considerable changes can be seen after July, 1984. The intensity of the superimposed blue continuum has been strongly decreased. This follows from the fact that the TiO molecular bands (4584 A, 4626 A, 4667 A, 4762 A), practically invisible in the older spectra, are clearly present and increasing in intensity on the plates of August and September 1984. The strongest absorption line in the M6 III star, viz. the Ca I 4227 A, is filled up by the hot continuum and shows only a deep and narrow shell-component, which is clearly visible now (central depth is about 0.6 on September 30).

Strong changes in the line spectrum of CH Cyg are also seen. The Balmer series is represented by clearly visible profiles up to H_{18}, being very wide and expanded to about 2000 km/s for H_{δ} and 2500 km/s for H_{β}. In Figure 1

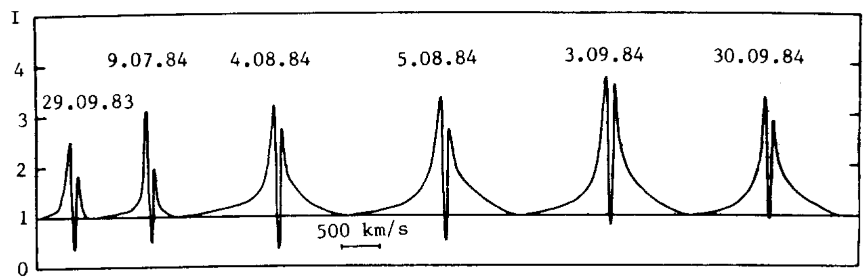

Figure 1

some earlier and recent profiles of H_δ are compared.

Lines of He I (3820 A, 4026 A, 4471 A, 4713 A, 5876 A) are present now with increasing intensity and significant width. The Fe II emissions are strong and have one component. The absorption components of Fe II, which were from time to time ones of the strongest features in the spectrum of the star in the last years, completely disappeared.

The forbidden lines have appeared increasing both in number and intensity. In addition to the [FeII] lines, [O I], [Ni II], [Cu II], [S II] are also present. It is interesting to point out the appearance of the lines [Ne III 1] 3869 A and [O III 2] 4363 A on September 3, the intensity of which were strengthened on September 30.

On the other side, the absorption spectrum is characterized by the increased intensity of the neutral metals, approaching to the M6 III spectrum. In addition to the metioned lack of Fe II absorptions, a very strong weakening of Ti II lines occurs, especially longward 3647 A. On the contrary, Fe I absorption lines are steadily strengthening. The Sc II, Sr II, V II, Cr I, Mn I, Mg I are strongly developed, too. The Ca II H and K lines show few components with different intensity. The Na I doublet lines have inverse P Cyg profiles.

The facts mentioned above, the decreasing brightness of the star and the intensification of the features characteristic of an M6 III spectrum suggest that the active phase of CH Cyg started in 1977 is probably over.

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PHOTOGRAPHIC OBSERVATIONS OF NOVA Her 1963 (=V 533 HERCULIS)

Nova Her 1963 (=V 533 Her) was observed with the 40 cm f/5 four-lense double astrograph of Beijing Observatory using blue plates (Eastman Kodak 103a O) during the 1980 June 5 - 1982 August 25 interval. The results are given in Table I. The magnitudes were measured with an iris photometer and calibrated by the selected area SA 38.

Table I

J.D.hel. (2 444 000 +)	m_{pg}	J.D.hel. (2 444 000 +)	m_{pg}
396.1049	$15^m.42$	493.0743	14.66
398.2812	15.16	493.0819	14.65
399.1285	15.36	493.0896	14.63
425.1924	14.58	495.0250	14.59
470.1486	14.81	496.0382	14.69
485.0694	14.65	498.0451	14.54
487.0069	14.54	498.0528	14.52
491.0528	14.51	498.0618	14.56
491.0604	14.56	498.0694	14.52
491.0680	14.51	498.0770	14.64
491.0757	14.68	498.0847	14.67
491.0833	14.76	498.0924	14.64
491.0910	14.69	498.1000	14.52
491.1132	14.62	498.1097	14.60
493.0153	14.59	498.1174	14.60
493.0285	14.73	499.1319	14.65
493.0361	14.72	500.1208	14.65
493.0438	14.73	825.2500	14.30
493.0514	14.65	1167.2562	14.27
493.0590	14.69	1194.1521	14.28
493.0667	14.65	1208.0840	14.22

The observational results are as follows:

1. During the observations the nova reached its prenova magnitude value (as before 1940) $m_{pg} \approx 15$ mag.

2. The star has a long-term brightness variation with an amplitude of more than a magnitude.

3. Short-term variations ($\Delta m \approx 0^{m}.2$) are also present during one night that may be caused by eclipses.

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OUTBURSTS OF THE STAR CASE 1

The object Case 1 ($\alpha = 12^h13^m16^s$; $\delta = +52^\circ47'.5$; 1950.0) is a close pair consisting of a DA white dwarf and a dM4e red dwarf (Lanning and Pesch, 1981). Lanning (1982) found that the radial velocity of the H_α line varies with the period $0^d.66765$ and the semiamplitude is K = 116 km/s. The period he found is apparently the orbital period in the close binary system. However, the author was not able to find any considerable variability.

The star was investigated using 430 plates of the Sternberg Institute plate collection taken in the interval J.D. 2 437 462 - 2 445 854 and three more plates (J.D. 2 418 771 - 2 419 126). The identification chart for the object is shown in Fig. 1. Table I gives photoelectric UBV-measures of neighbour stars. Our plate material shows minor brightness changes in the range 13.6 - 13.9 B , which is comparable with the errors of photographic photometry. It was, however, possible to find two reliable outbursts to 13^mB . The moments of the outbursts and adjacent observations are given in Table II.

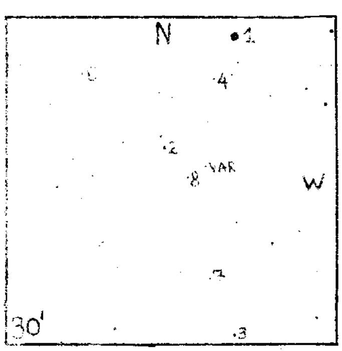

Figure 1

Table I

stars	V	B-V	U-B
1	7.54	+1.06	+0.87 *
2	11.62	+0.66	+0.20 **
3	12.27	+0.55	+0.03
4	12.54	+1.55	+1.0
5	12.80	+0.58	-0.04
6	13.00	+0.59	+0.03
7	13.24	+0.75	+0.15
8	13.83	+0.71	+0.11

* BD + 53° 1535

** the standard star for photo-electric observations

The occurrence of outbursts could be explained by an increase of the rate of accretion on the white dwarf, probably from the thin disk surrounding it. Thus the system is semidetached or almost semidetached, since there

Table II

J.D.	B	J.D.	B
2438139.370	13.69	2439919.316	13.62
142.360	13.02	936.320	13.18
142.391	13.12	937.304	13.84
145.342	13.67		

Table III

J.D.	V	B–V	U–B
2445852.319	13.25	+0.54	–0.49
854.328	13.21	+0.53	–0.49
858.302	13.25	+0.56	–0.46
858.308	13.23	+0.54	–0.44
858.322	13.24	+0.54	–0.45
858.337	13.24	+0.53	–0.44
858.345	13.20	+0.54	–0.42
858.356	13.20	+0.58	–0.45

appears a possibility of accretion of matter from the cooler star onto the hot one.

Our photoelectric observations are given in Table III where no noticeable variability is apparent. Eggen and Greenstein (1965) give the following values for the variable: $V = 13^{m}.34$; $B-V = +0^{m}.53$; $U-B = -0^{m}.48$.

It is worth noting that the star No.4 on our chart is possibly a slow variable with an amplitude not exceeding 1^{m}.

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V566 OPHIUCHI - PERIOD UPDATE

The variability of V566 Ophiuchi which is classified as an A-type W Ursae Majoris system, was discovered in 1935 by Hoffmeister (1935). The system undergoes complete eclipses, secondary being total. The primary component which is the larger and brighter star, overflows its Roche lobe but no material exits the system through the outer Lagrangian surface (Mochnacki and Doughty, 1972).

Fresa (1954) obtained the first photoelectric observations (partial eclipses) in unfiltered light. Binnendijk (1959) used B and V filters and obtained complete light curves. Bookmyer (1969) made a further study of the system, incorporating observations by Purgathofer, Widorn (1959) and Schnell, Widorn (1965). Her study confirmed the unusual 14-year long period constancy of the system, earlier detected by Kwee (1958) and Binnendijk (1959). Additional light curves were obtained by Bookmyer (1976) based on some 2000 photoelectric observations. By this time it had become evident that a period increase of the order of $0\overset{s}{.}26$, suspected earlier by Kaitchuck and Sprague (1974), had occurred around 1969. Maddox and Bookmyer (1981) presented the most extensive update of the system, incorporating its period behaviour, covering about 45 years and listing some 100 minima obtained between JDH 2,434,179 and 2,443,677. The observational history of the system is fully documented in their paper.

Mahdy and Soliman (1982) observed V566 in 1981 while the author did so during six nights in the time interval between 15 July and 20 August 1982, using photoelectric equipment attached to the 38-cm reflector of Midway Observatory. Additional photoelectric observations were made on campus with the 36-cm reflector of Webb Observatory, Toowoomba. The equipment and observational procedures have been described previously (Kennedy, Wisniewski, 1980; Kennedy 1982). Our observations yielded two primary eclipses and one secondary. Enough data were obtained to present a complete light curve (ΔV), Fig. 1. Maximum light (V) has been normalised to zero. Recorded times of minima (ΔV) obtained by Mahdy and Soliman (1982) and those obtained by us are listed in Table I.

Phases and residuals were computed from the ephemeris given by Bookmyer (1969):

$$\text{J.D. Hel. Min. I} = 2436744.4200 + 0\overset{d}{.}40964091\ E$$

and are plotted versus heliocentric Julian Date in Fig. 2, together with all minima (I and II) after J.D. Hel. 2,440,400 as tabulated by Maddox and Bookmyer (1981).

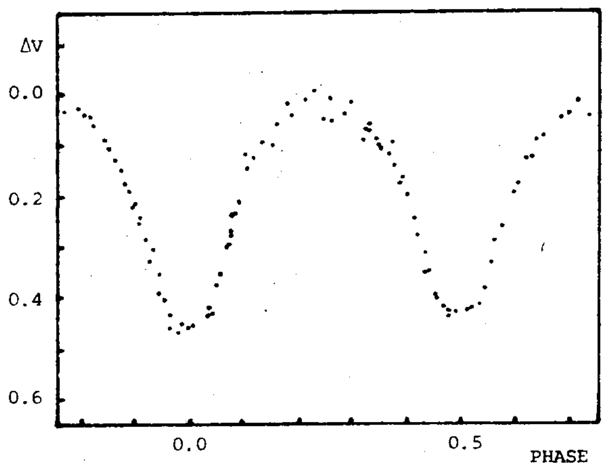

Figure 1: Lightcurve of V566 Oph

Table I

J.D. Hel. 2440000+	Min.	Phase	(O - C)	Ref.
4750.4901	I	.1175	+ $0^{d}.0481$	Mahdy, Soliman (1982)
4751.5162	II	.6224	+ $0^{d}.0501$	Mahdy, Soliman (1982)
4825.2510	II	.6210	+ $0^{d}.0495$	Mahdy, Soliman (1982)
4826.2739	I	.1181	+ $0^{d}.0483$	Mahdy, Soliman (1982)
4827.2992	II	.6210	+ $0^{d}.0495$	Mahdy, Soliman (1982)
5169.9749	I	.1480	+ $0^{d}.0606$	Kennedy
5170.9988	II	.6475	+ $0^{d}.0604$	Kennedy
5197.0117	I	.1493	+ $0^{d}.0611$	Kennedy

Fig. 2 shows the period behaviour after the 1969 period change. In order to compare the period change of V566 Oph with a number of other photometric binaries displaying similar behaviour (Kennedy, 1982), the period diagram has been rectified, i.e. the branch of steadily increasing residuals has been plotted horizontally. Fig. 3 shows the rectified period diagram which includes all primary minima as listed by Maddox and Bookmyer (1981) as well as those listed in Table I. This diagram is based on the ephemeris:

$$\text{J.D. Hel. Min. I} = 2{,}441{,}119.8016 + 0^{d}.40964579\ E.$$

The largest residual (for the horizontal branch) is $0^{d}.0055$. The accuracy of the determination of the period after the 1969 change improves as additional observational data becomes available. Table II lists the new

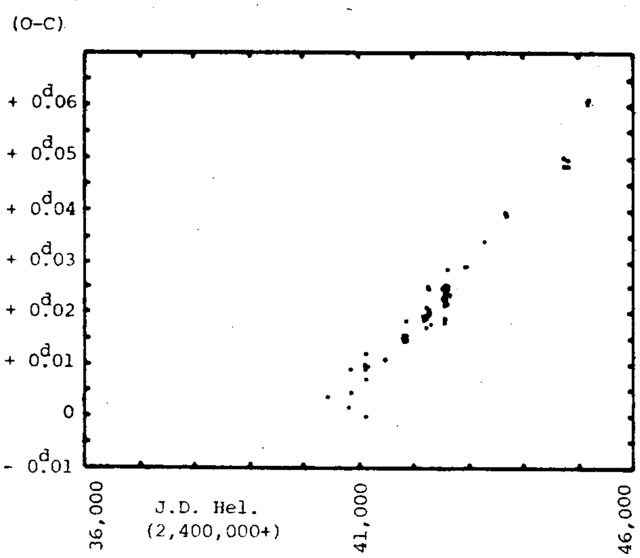

Figure 2: Period Behaviour of V566 Oph after J.D. 2,440,400

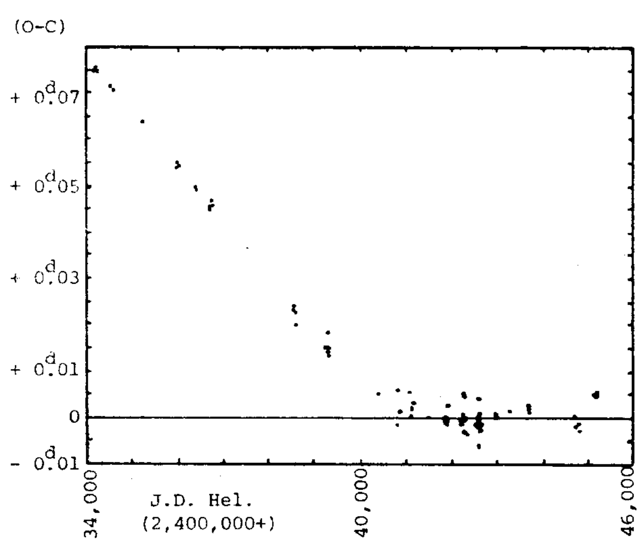

Figure 3: Rectified Period Behaviour of V566 Oph

Table II

Period	Incr.	Ref.
$0^{d}.40964101$		Binnendijk (1959)
$0^{d}.40964091$		Bookmyer (1969)
$0^{d}.40964387$	$0^{s}.26$	Bookmyer (1976)
$0^{d}.40964399$	$0^{s}.26$	Bookmyer (1976)
$0^{d}.40964431$	$0^{s}.29$	Dawson *et al.* (1977)
$0^{d}.40964660$	$0^{s}.49$	Maddox *et al.* (1981)
$0^{d}.40964504$	$0^{s}.36$	Maddox *et al.* (1981)
$0^{d}.40964579$	$0^{s}.42$	Kennedy

periods and period increases published so far, indicating an average value of $0^{s}.36$. Insignificance of the quadratic term does not appear to warrant a quadratic solution.

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THE ABSENCE OF INTERCHANGES IN AC HERCULIS

Several statements concerning AC Her published by C. Payne-Gaposchkin, V. Brenton and S. Gaposchkin in their study of RV Tauri stars (Harvard Ann., 113, No.1, 1943) proved to be incorrect. These statements are "Interchanges (between the primary and secondary light minima - G.E.) are quite uncommon, for instance, for AC Herculis ..." on page 37, the average interval between the interchanges 50 epochs (with the total observation interval about 200 epochs) and the amplitude of fluctuation of light maxima $1^{m}.6$ in the table XVII. The statement in the paper by Preston et al. (Ap.J., 137, 401, 1963) with reference to Harvard Annals 113, No.1, 1943 is neither true that "... the depth of secondary minimum for AC Her, as predicted from a uniform ephemeris, was found to exceed that of primary minimum only five times in a 40-year period." These statements were quoted partially by Magalashvili and Kumsishvili (Abastumani Bull., No.43, 1972), Nakagiri and Jamashita (Tokyo Bull., No.260, 1979), Baird (Ap.J., 245, 208, 1981) and even GCVS (1969).

The revision of the photographic observations of AC Her from Payne-Gaposchkin et al.'s paper showed that the interchanges of minima were not detected. The period changes are small, therefore the possibility to miscalculate the predicted phases of primary and secondary minima can be excluded. The improved mean elements

$$\text{Min I} = \text{J.D. } 2\,435\,052 + 75^{d}.439\ E$$

were used. These elements were obtained by the author on the basis of 587 primary and secondary light minima. No shallow minima were observed at the phases of primary minima. The deepest secondary minima did not reach the depth of primary ones. These minima are as follows:

J.D.	I_{pg}	Number of obs.	Phase
2 415 632	8.9	4	0.577
16 155	8.94	1	.510
20 680	8.9	4	.491
26 260	8.85	4	.457
26 648	8.84	1	.600

The mean magnitudes of light extrema from Harvard observations are as follows:

Min I $= 9^{m}.18 \pm 0^{m}.08$

Min II $= 8.63 \pm 0.10$

Max I $= 8.09 \pm 0.18$

Max II $= 8.28 \pm 0.14$

The mean quadratic deviations of the extrema are also given. The absence of the interchanges between minima of AC Her was already noted earlier in my paper (Variable Stars, Moscow, 18, 301, 1972). No interchanges were found from numerous photoelectric observations of the recent years.

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ON POSSIBLE OPTICAL COUNTERPARTS OF THE
GAMMA BURST SOURCES GB 790 325 AND GBS 1703 +01

GB 790 325

The position of this source is approximately identical with that of the small-range slowly varying M giant V 669 Herculis (= 104 Herculis). Although this coincidence might easily be purely spurious it should be mentioned because obviously it has escaped attention so far.

GBS 1703 +01

Altogether 669 Sonneberg sky patrol plates of the years 1956 to 1983 and 31 plates taken with the 17/120 cm astrographic camera in the years 1932 to 1935 were examined for eruptions in the optical region at the error box of the burst position. The exposure times of the plates range from 30 ... 60 minutes (sky patrol) to 1 ... 3 hours (astrographic camera).

On the plate Te2 7679 of 1974 May 17.981 (middle of exposure time, heliocentric UT) a clearly visible star-like image has been found very near the position of the source. Just like Schaefer's well-known case of GBS 0117 -29 (Nature 294, p.722, 1981) the image differs slightly in shape from "ordinary" stars, the latter being elongated by a small guiding error. The photographic brightness was determined as $\approx 11^{m}_{.}2$ (Mt.Wilson system) by comparing with SA 108, the threshold of the respective plate being $13^{m}_{.}0$. On a simultaneously taken mpv exposure (limiting magnitude $\approx 12^{m}_{.}0$) no sign of any image can be perceived at the given position. It should be noted that both Schaefer's and our object can be explained also as being plate faults. Therefore many more observations are needed.

This work was done under the supervision of Drs. W. Götz and W. Wenzel of Sonneberg Observatory.

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THE BRIGHT ECLIPSING BINARY HD 208496

HD 208496 = HR 8369 (spectral type F3V) is a bright eclipsing binary which has received little attention up to now. It is not listed in the General Catalogue of Variable Stars though the 1982 edition of the Bright Stars mentions it as a suspected eclipsing binary.

Manfroid and Renson (1983) used it as a comparison for the CP star HD 208217 in a photometric observing run in September 1981 with the ESO 50 cm Danish Telescope. From 15 points they derived a possible period of 0.73 day and a range of more than 0.2 magn. in u,v,b and y.

More observations were obtained in July 1984 at the ESO 1m telescope. The star was caught twice in a descending phase and was then followed to a minimum. Unfortunately only a few points were taken in the ascending phases.

Analysis by the Stellingwerf method and examination of the phase diagram gives a frequency of:

$$f = 0.683038 \pm n\ (0.000965)\ d^{-1} \qquad n = 0,\ 1,\ 2,\ 3.$$

The error on f being about 0.000005 d^{-1}

The y lightcurve corresponding to $f = 0.683038\ d^{-1}$ ($P = 1.464047$ d) is presented in Fig. 1.

The colors show only small variations, within the observational errors. Although the phase coverage is less than uniform, we suspect an asymmetry in the shape of the secondary minimum. Clearly additional data are needed in order to confirm it.

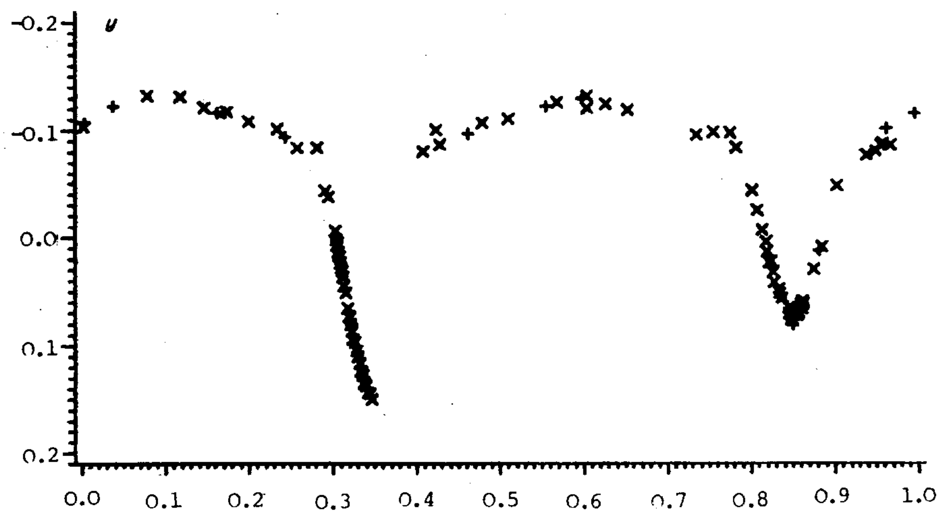

Figure 1

Phase diagram for HD 208496 in *y*. (+ September 1981; x July 1984). The period is 1.464047 d.

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Reference:

Manfroid, J. and Renson, P., 1983, IAU Inform. Bull. Var. Stars, No. 2311.

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PHOTOGRAPHIC PHOTOMETRY OF V 1515 CYGNI IN THE YEARS 1983 - 1984

The results of the photographic photometry of V 1515 Cygni — the third comfirmed member of fuors (the group of FU Orionis stars) — in the interval from May 1983 to August 1984 are presented.

Table I

J.D.244...	u	J.D.244...	u	J.D.244...	u
5469.510	15.02	5588.336	15.24	5914.422	15.00
5469.517	15.03	5588.344	15.70	5914.458	15.44
5469.555	15.30	5588.351	15.32	5914.465	15.53
5469.563	15.45	5588.384	15.30	5914.472	15.40
5469.569	15.70	5588.392	15.42	5914.479	15.52
5470.546	15.20	5588.494	15.00	5916.462	15.28
5470.553	15.60	5588.501	15.11	5916.470	15.20
5471.513	15.43	5883.481	15.12	5917.517	15.36
5471.519	15.58	5883.488	15.04	5917.524	15.39
5471.527	15.50	5883.495	15.00	5920.503	15.00
5471.534	15.85	5883.502	15.22	5920.510	15.42
5471.553	15.22	5885.444	15.28	5920.517	15.20
5496.463	15.50	5885.451	15.07	5920.524	15.18
5496.470	16.10	5885.458	15.20	5920.551	15.18
5496.518	15.49	5914.365	15.38	5920.558	15.16
5496.526	15.45	5914.407	15.70	5920.566	14.90
5496.533	15.68	5914.414	15.00	5920.573	15.42
5587.515	15.13				

We estimated the magnitudes of V 1515 Cygni (see Table I) on 21 multi-exposure plates (20/28 inch Schmidt telescope, ORWO ZU 21 emulsion, UG2 filter) using the same photometer and standard stars as published in our previous paper (IBVS, No. 2236, 1982). The multiexposure plates used offer the possibility to observe a quick variability of the order of a 10-minute exposure.

For the 1983 - 1984 period the star has kept its brightness, reached at the end of 1982, which is lower than the brightness of the star at the end of

1979 before its decrease in 1980. During the measurements the brightness of the star varied with an amplitude of 0.7 mag in the U-band sometimes within one hour.

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PHOTOELECTRIC OBSERVATIONS OF AD LEONIS

Continuous photoelectric monitoring of the flare star AD Leo was carried out at the Stephanion Observatory and the National Astronomical Observatory at Rozhen during 1980 - 1984 within the framework of the Program for Scientific and Technical Co-operation between the Department of Geodetic Astronomy, University of Thessaloniki, Greece and the Department of Astronomy and National Astronomical Observatory, Bulgarian Academy of Sciences, Bulgaria.

Observations were made with the 30 inch Cassegrain reflector at the Stephanion Observatory equipped with a Johnson dual channel photoelectric photometer, in the B colour and with the 60 cm Cassegrain reflector at Rozhen equipped with an EF-1 one channel photoelectric photometer, in the U colour of the international UBV system. The telescopes and the photometers used have been described elsewhere (Mavridis et al., 1982; Panov et al., 1982). The transformations of our instrumental ubv systems to the international UBV system for the period of 1980 - 1984 is given by the following equations:

$$V = v_o - 0.011(b-v)_o + 3.191$$
$$B-V = 0.569 + 1.022(b-v)_o \qquad (1980,\ \text{Stephanion})$$
$$U-B = -1.858 + 0.962(u-b)_o$$

$$\Delta V = \Delta v - 0.12\ (b-v)$$
$$\Delta(B-V) = 1.14\Delta(b-v) \qquad (1982-1984,\ \text{Rozhen})$$
$$\Delta(U-B) = 1.08\Delta(u-b)$$

The monitoring intervals in U.T., as well as the total monitoring time for each night are given in Table I. The standard deviation of random noise fluctuation ($\sigma_{mag} = 2.5 \log (I_o+\sigma)/I_o$) for different times (U.T.) of the corresponding monitoring intervals is given in the fourth column of Table I.

During the 5.9 hours of monitoring time one flare was observed, the characteristics of which are given in Table II. The following characteristics (Andrews et al., 1969) for the flare are given:

a. the date and universal time of the maximum;

b. the duration before and after the maximum (t_b and t_a, respectively),

Table I

Monitoring intervals in 1980 - 1984

Date	Monitoring intervals (U.T.)	Total Mon.Time	σ (U.T.)
	(at Stephanion)		
1980 March 20/21	20^h34^m–20^h58^m, 21^h04^m–21^h49^m, 21 58 -22 15 , 22 16 -22 56 22 57 -00 31.	3^h40^m	0.03 (20^h42^m), 0.03 (21^h40^m), 0.03 (22 05), 0.03 (22 29), 0.03 (00 00).
	(at Rozhen)		
1982 Feb.21/22	$23^h47^m14^s$–$00^h07^m38^s$	20^m24^s	0.04 (23^h55^m).
Oct. 27	01 57 18 -02 03 27,		0.04 (02 00),
	02 06 33 -02 19 19,		0.03 (02 13),
	02 23 46 -02 27 37,		0.04 (02 25),
	02 33 22 -02 52 18,		0.03 (02 41),
	02 56 21 -03 05 33,		0.04 (02 59),
	03 06 42 -03 09 10,		0.03 (03 07),
	03 10 12 -03 12 52,		0.04 (03 11),
	03 13 42 -03 16 03,		0.03 (03 14),
	03 16 43 -03 20 57.	60^m37^s	0.03 (03 18).
1984 March 28	21 18 37 -21 32 55,		0.05 (21 25),
	21 41 26 -21 48 09,		0.05 (21 44),
	21 53 43 -22 11 29,		0.04 (22 05),
	22 16 01 -22 26 29,		0.04 (22 20),
	22 29 38 -22 32 25.	52^m02^s	0.04 (22 30).
		Total $=5^h53^m03^s$	

Table II

Characteristics of the observed flare

Date	U.T. max.	t_b min	t_a min	duration min.	$\frac{I_f-I_o}{I_o}$	P min	Δm mag	σ mag	Air mass
Mar. 28	$22^h21^m.4$	0.9	4.0	4.9	0.274	0.330	0.26	0.04	1.217

as well as the total duration of the flare;

c. the value of the ratio $(I_f-I_o)/I_o$ corresponding to the flare maximum, where I_o is the intensity deflection of the quiet star lessened with sky background and I_f is the total intensity deflection of the star plus flare lessened with sky background;

d. the integrated intensity of the flare over its total duration, including pre-flares, if present: $P = \int (I_f-I_o)/I_o dt$;

e. the increase of the apparent magnitude of the star at flare maximum $\Delta m(u) = 2.5 \log (I_f/I_o)$, where u is the ultraviolet magnitude of the star in the instrumental system;

f. the standard deviation of random noise fluctuation, $\sigma_{mag} = 2.5 \log (I_o+\sigma)/I_o$,

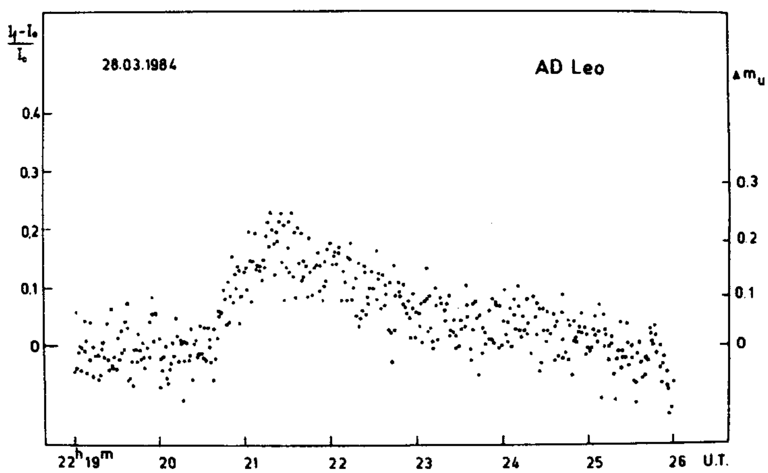

Figure 1

during the quiet-state phase immediately preceding the beginning of the flare;

g. the air mass at the flare maximum.

The light curve of the observed flare in the u-colour is shown in Figure 1.

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HR 1321 = ADS 3085 B : A NEW VARIABLE STAR

The bright star HR 1321 = HD 26913 is the fainter component of the visual binary ADS 3085. About 12 years ago the brighter component (HR 1322 = HD 26923) was found by Blanco et al. (1972) to be variable; later it was designated V774 Tauri by Kholopov et al. (1981). The photometry reported by Blanco et al. also showed some indication that HR 1321 was variable, with a range of approximately $0\overset{m}{.}03$ in V, but their data were neither tabulated nor plotted, so we cannot judge whether or not the suspected variability was periodic. On the strength of that reference HR 1321 was assigned the suspected variable star number NSV 1534.

In January and February of 1984 we observed HR 1321 differentially with respect to the comparison star HR 1360 on 18 nights. Care was taken to exclude light from HR 1322, which is only 65 arcseconds away. The telescope was the 11-inch Schmidt-Cassegrain at Gila Observatory, which has been described by Ziegler (1983). Table I lists the nightly means, where Δ is in the sense variable minus comparison and every value has been corrected for differential atmospheric extinction and transformed differentially to V of the UBV system. Figure 1 is a plot of those values using a period of $6\overset{d}{.}8$, which seems to represent the periodicity evident in the data, with an uncertainty of approximately $\pm\ 0\overset{d}{.}2$. The total range in brightness is approximately $0\overset{m}{.}06$ in V. A time of minimum brightness would be JD 2445719.7 .

We have found three references presenting measures of the Ca II H and K flux. Observations by Wilson (1978) between 1966 and 1972 showed no evidence of short-term variability but did indicate some "secular decrease". Similar observations by Middlekoop et al. (1981) over a 10-day interval did show short-term variability with a period (we estimate from their figure 2) of approximately 7 days. Nightly observations by Vaughan et al. (1981) over a 14-week interval also showed short-term variability, with a range of 11 % and a period of $7\overset{d}{.}2$.

Table I

Differential Photoelectric Photometry of HR 1321

JD(hel.) 2445000+	ΔV	JD(hel.) 2445000+	ΔV
719.71	$+1^{m}.215$	729.780	$+1^{m}.172$
720.79	+1.208	730.715	+1.185
722.687	+1.153	731.644	+1.194
723.717	+1.176	734.653	+1.200
724.707	+1.194	735.742	+1.164
725.756	+1.204	737.738	+1.181
726.692	+1.209	739.608	+1.197
727.825	+1.168	750.669	+1.185
728.699	+1.182	751.650	+1.190

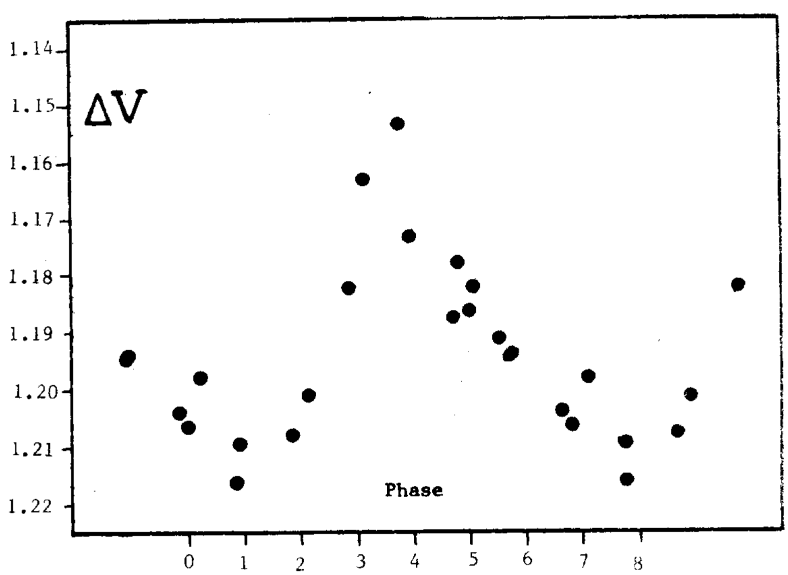

Figure 1

Light curve of the newly discovered variable star HR 1321. The ordinate is differential magnitude. The abscissa is phase, in days, based on a period of 6.8 days. Each point is a nightly mean although, in one case, two points overlap.

Vaughan et al. concluded that their $7^{d}_{\cdot}2$ period was the rotational period, traced by chromospherically active regions on the star's surface. Similarly, we believe that our $6^{d}_{\cdot}8 \pm 0^{d}_{\cdot}2$ period is the same rotational period, traced by areas of the photosphere which are darkened by large-scale starspot activity.

With additional photometry during the next observing season we should be able to refine the accuracy of the photometric (= rotational) period of this interesting star, which is bright enough ($V = 6^{m}_{\cdot}93$) to be observed conveniently and important now that we see it belongs to a visual binary system both components of which are variable stars.

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NEW FLARE STARS IN THE Mon I ASSOCIATION

A search for flare stars in the region of Mon I association was carried out by one of the authors (L.R.) during the years 1974 - 1976 and 1981 in the Asiago Astrophysical Observatory of the University of Padova, with the 67/90/192 cm Schmidt telescope. The exposures were made on Kodak 103a-O plates without filter, using the chain method. During 55 hours of effective time 150 plates were obtained, each with five star images. The exposure time was 5 minutes for each image.

As a result of the examination of these plates, which cover a region of about 25 square degrees centered at the cluster NGC 2264, 29 new flare stars were discovered.

The new flare stars are listed in Table I where the following data are given in the consecutive columns: serial number, name of the star, equatorial coordinates, magnitude at minimum, amplitude of the flare-up and date of the flare.

The discussion of the data will appear in the publications of the Byurakan Observatory.

Table I

New flare stars in the region of Mon I

No.	Star name	α_{1900}	δ_{1900}	m_{pg}	A_{pg}	Date
1		$6^h28^m.2$	10°06'.7	$16^m.6$	$1^m.7$	Jan. 19 1974
2		29.2	10 32 .3	16.6	0.6	Dec. 16 1974
3		30.0	9 32 .8	17.0	0.7	Feb. 5 1975
4		32.0	11 19 .5	18.5	3.5	Feb. 6 1974
5		32.5	8 18 .6	16.3	1.0	Oct. 28 1973
6		32.5	9 39 .6	16.4	0.6	Apr. 3 1976
7		33.2	9 16 .6	16.6	1.3	Apr. 3 1976
8		33.5	8 26 .6	16.8	1.0	Dec. 9 1974
9		33.8	9 23 .4	16.7	0.7	Jan. 22 1976
10		33.8	9 25 .6	15.6	0.9	Sep. 9 1974
					0.6	Dec. 18 1974

Table I (cont.)

No.	Star name	α_{1900}	δ_{1900}	m_{pg}	A_{pg}	Date
11		$6^h34^m.0$	$8^\circ 27'.7$	$17^m.0$	$1^m.0$	Dec. 9 1974
12		34.1	10 25 .7	19.0	4.2	Nov.17-18 1974
13		34.2	10 27 .7	16.7	0.5	Feb.27 1976
14		34.3	9 16..2	20.3	4.5	Jan.19 1974
15		34.3	9 33 .7	17.8	2.0	Dec. 6 1981
16		34.8	10 05 .6	16.7	1.0	Oct.31 1973
17		35.1	8 57 .0	17.2	0.6	Feb. 9 1975
18	V418	35.3	9 27 .8	18.2	2.7	Oct.31 1973
19		35.8	9 41 .8	19.2	2.7	Dec.15 1974
20		36.0	9 57 .8	18.9	2.3	Dec.21 1974
21		36.1	9 54 .8	18.1	1.8	Nov.18 1974
22		36.3	9 38 .8	17.8	1.4	Jan.10 1975
23		37.3	9 17 .8	16.7	0.7	Dec. 6 1974
24		37.3	10 28 .6	17.0	0.6	Feb. 5 1975
25		37.9	9 40 .9	17.3	1.0	Feb. 8 1975
26		38.3	9 19 .0	17.2	1.0	Feb. 5 1975
27		38.7	8 20 .0	17.0	0.5	Dec. 9 1974
28		42.2	9 11 .3	16.1	0.7	Dec. 11 1975
29		45.3	10 31 .5	16.1	1.1	Feb. 24 1976

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FLARE STARS IN ORION

The search for flare stars in stellar aggregates, associations and young stellar clusters has been going on at the Byurakan Astrophysical Observatory for about 20 years (Chavushian et al., 1979; Melikian, 1981; Mirzoyan, 1964; Natsvlishvili and Melikian, 1980). Among other aggregates, observations of the Orion nebula region have been made, as well. During 102 hours of effective observational time 28 flares have been detected, 19 of those being detected on new flare stars. Some results concerning these observations, especially the results of the synchronous UBV observations have already been published (Mirzoyan et al., 1981, 1983). In general, these observations were carried out with the 40" and 21" Schmidt telescopes of the Byurakan Observatory. The method of observations was the common one of multiple and equal exposures of 5 or 10 minutes.

In the present paper the data about the observed flares (see Table I) and the identification charts for the 19 new flare stars (see Figure 1) are given.

The following data are presented in the respective columns of Table I:

1. The Byurakan number of the flare star (N);
2. Parenago's number (NP);
3. Haro's number (NH);

4.-5. Coordinates for 1900.0

6. The magnitude of the flare star at minimum (m_u);
7. The amplitude of the flare (ΔU or Δpg);
8. The telescope which was used for the detection of the flare;
9. The date of the occurrence of the flare.

In seven cases the rise of the flare lasted more than 10 minutes. These are "slow" flares according to the classification of Haro (1964). In Table II the numbers and the rise times for these flares are presented.

The light curve of the outburst on the star No.20 had a very interesting shape. In Table I one can see that the amplitude of this flare in the U band

Table I. Flare stars in Orion

N	NP	NH	$\alpha_{1900\cdot0}$	$\delta_{1900\cdot0}$	m_u	Δu	tel.	date
B1			$5^h30^m.3$	$-5^o51'$	$16^m.5$pg	$1^m.2$pg	40"	25.10.1962
B2	1215	136	28.8	-4 17	17.5pg	2.4pg	40"	14.01.1964
B3		254	38.0	-5 51	16.5pg	1.3pg	40"	12.02.1964
B4			30.0	-5 49	16.5pg	1.5pg	40"	03.10.1970
B5			29.6	-5 05	18.0	4.5	40"	07.03.1975
B6		236	31.7	-5 41	18.7	>3.5	40"	08.03.1975
B7			38.7	-4 58	20.0	6.5	40"	08.03.1975
B8			26.8	-7 15	18.7	5.2	40"	10.11.1977
B9		207	29.3	-6 00	17.6	2.1	40"	07.11.1977
B10			20.4	-4 39	17.6	4.1	40"	19.10.1979
B11	2176		28.4	-4 23	15.5	1.7	40"	18.12.1979
B12			22.5	-7 06	18.4	5.0	40"	18.12.1979
B13			27.1	-5 43	18.0v	1.8v	28"	21.12.1979
B14		129	27.0	-4 31	18.2	5.7	40"	18.12.1979
B15		187	27.3	-7 08	18.0	4.6	40"	25.11.1978
B16			37.1	-5 14	21	7.0	40"	29.11.1978
B17	1167	194	28.5	-5 37	17.8	2.1	40"	29.01.1979
B18			31.7	-3 48	19.0	3.5	40"	29.01.1979
B19			30.2	-4 30	17.7	3.5	40"	17.10.1980
B20	2572		32.8	-5 16	17.4	5.4	40"	22.10.1980
B21	1588		29.7	-5 38	18.0	3.7	40"	22.10.1980
B22	2618		33.0	-6 28	15.0	1.0	40"	22.10.1980
B23	1463	31	29.5	-5 00	17.4	4.2	40"	04.11.1980
B24	847		27.2	-5 07	17.4	4.5	40"	04.11.1980
B25	1471		29.5	-5 37	17.8	2.5	40"	04.11.1980
B26			28.1	-4 14	15.8	1.2	40"	01.12.1980
B27	2368	231	31.3	-5 16	15.5	1.4	40"	07.12.1980
B28	2381		31.5	-6 06	15.1	4.3	40"	03.11.1980

Table II. Slow flares in Orion

N	B6	B9	B12	B14	B15	B22	B24
Rise time (min.)	30	20	15	10	10	10	10

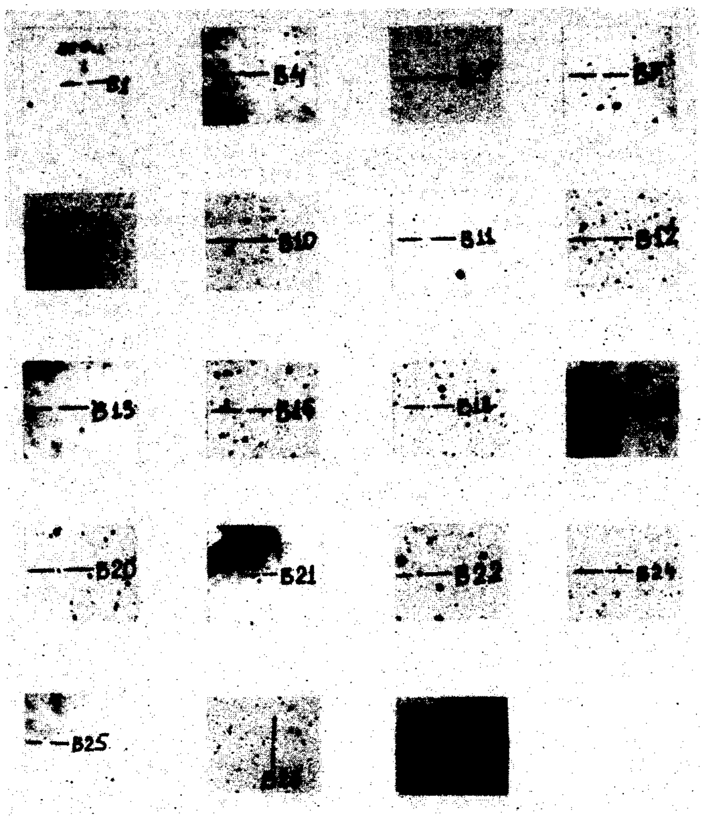

Figure 1

is equal to $5\overset{m}{.}4$. The brightness during this flare increased within few minutes and remained at the maximum for more than 3 hours.

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UNUSUAL "RED" FLARE ON THE STAR T 231 = AZ Ori

Synchronous UBV observations of stellar flares in the Pleiades and Orion regions were carried out in Byurakan (Armenia, USSR) and Abastumani (Georgia, USSR) Astrophysical Observatories between 1979 and 1981. The results of these simultaneous photographic observations, obtained with three wide-angle telescopes, are published in the papers by Mirzoyan et al. (1981 and 1983) where the details about the method of these observations (photographic plates and filters used) and some other data can also be found.

The observations showed (Mirzoyan et al., 1981, 1983) that the colorimetric characteristics of flares both on the flare stars in clusters and associations and on the UV Ceti type flare stars in the solar vicinity were almost the same. Generally, in both cases the following inequality exists for the amplitudes ΔU, ΔB and ΔV :

$$\Delta U > \Delta B > \Delta V \quad .$$

During our synchronous colorimetric observations, however, an unusual flare was detected on the star T 231 with very red colours. In this case a reverse inequality was noticed:

$$\Delta U < \Delta B < \Delta V \quad .$$

The details of this flare are given in Table I, where the following data are listed:

1. the universal time for each measurement (image);
2.-4. the amplitudes ΔU, ΔB and ΔV;
5.-6. the $(U-B)_+$ and $(B-V)_+$ colour indices of the flare, calculated by means of the formulae given by Mirzoyan (1966);

The data in Table 1 show that the total duration of this flare was about four hours, and the $(U-B)_+$ and $(B-V)_+$ colours of the flare were redder all the time than the colours of the star T 231 = AZ Ori itself, in normal state ($B-V = +1\overset{m}{.}1$, $U-B = +0\overset{m}{.}5$; Mirzoyan et al., 1983). These results are presented in Figure 1.

Table I

The "red" flare on the star T 231 = AZ Ori

U.T.	ΔU	ΔB	ΔV	$(U-B)_+$	$(B-V)_+$
$22^h02^m.5$	$1^m.4$	$1^m.5$	$1^m.7$	$0^m.6$	$1^m.4$
08.5	1.4	1.5	1.7	0.6	1.4
14.5	1.2	1.2	1.6	0.5	1.7
20.5	1.1	1.5	1.9	1.0	1.7
26.5	0.7	1.2	1.3	1.3	1.3
32.5	0.7	1.2	1.7	1.3	1.8
38.5	0.7	1.1	1.2	1.3	1.3
44.5	0.6	0.9	1.6	1.1	2.2
56.5	–	1.2	–	–	–
23 02.5	0.9	1.0	–	1.0	–
08.5	0.8	0.9	1.8	0.6	2.4
14.5	0.9	0.9	1.4	0.5	1.9
20.5	0.6	1.0	1.8	1.3	2.3
26.5	0.7	1.2	1.4	1.3	1.4
32.5	0.5	1.0	1.2	1.5	1.5
38.5	0.5	0.9	1.2	1.3	1.6
44.5	0.5	–	1.2	–	–
00 02.5	0.9	1.4	–	1.2	–
08.5	1.3	1.2	–	0.3	–
14.5	1.0	1.1	–	0.7	–
20.5	0.7	1.2	–	1.3	–
26.5	0.5	1.4	–	2.1	–
32.5	0.6	1.1	–	1.5	–
38.5	0.6	1.0	–	1.2	–
44.5	–	1.2	–	–	–
01 02.5	0.9	1.4	–	1.2	–
08.5	1.3	1.2	–	0.3	–
14.5	1.0	1.1	–	0.7	–
20.5	0.7	1.2	–	1.3	–
26.5	0.5	1.4	–	2.1	–
32.5	0.6	1.1	–	1.5	–
38.5	0.6	1.0	–	1.2	–
44.5	–	1.2	–	–	–
56.5	1.1	1.1	–	0.5	–
02 02.5	0.6	0.9	–	1.1	–
08.5	0.9	0.9	–	0.5	–
14.5	0.7	1.0	–	1.0	–
20.5	0.7	1.0	–	1.0	–
26.5	0.2	0.9	–	–	–

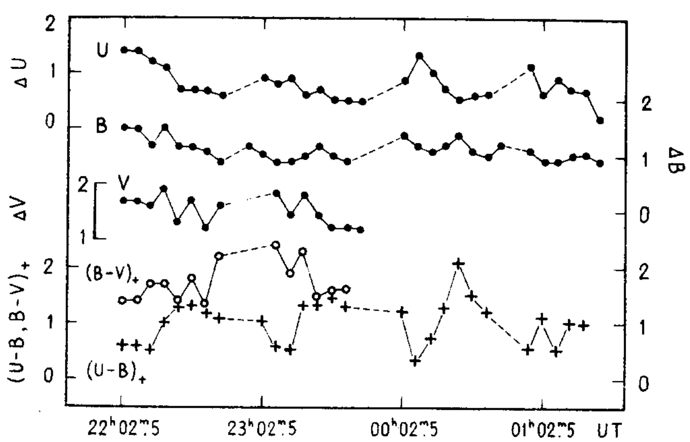

Figure 1. The light curves in the U, B, and V bands and the variations of the flare colours (circles: $(U-B)_+$; crosses: $(B-V)_+$) during the "red" flare on the star T 231 = AZ Ori. After 00^h00^m (U.T.) the observations in the V-band were stopped (in Abastumani) because of weather conditions.

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PRIMARY MINIMUM OF W CRUCIS

In response to the request by Plavec (1984) for observations of W Crucis during the primary eclipse predicted for JD 2445893, photoelectric photometry was carried out on the 1.0m and 0.5m telescopes at the Sutherland observing station of S.A.A.O. by J. Spencer Jones, F. Marang and J. D. Laing. The nearby Star HD 106015 was used as a comparison star and was assumed to have the following magnitude and colours: V = 8.990, B-V = 0.110, U-B = 0.237, $(V-R)_C$ = 0.094 and $(V-I)_C$ = 0.200 where the last two colours are on the Cousins' System (Cousins, 1980). The results are listed in Table 1 below. Errors are estimated to be ± 0.005 for all quantities.

Table 1
Photometry of W Cru

HJD 2445800+	V	B-V	U-B	$(V-R)_C$	$(V-I)_C$
85.297	8.860	1.146	0.710	0.633	1.180
86.260	8.899	1.140	0.683	0.627	1.168
87.252	8.945	1.152	0.702	0.635	1.178
88.258	8.968	1.152	0.665	0.631	1.166
89.244	8.978	1.143	0.615	0.632	1.169
90.248	8.992	1.117	0.575	0.624	1.163
91.248	8.997	1.125	0.582	0.621	1.159
92.255	8.995	1.118	0.570	0.612	1.137
93.241	8.992	1.106	0.525	0.617	1.139
97.273	8.988	1.112	0.609	0.614	1.129
100.267	8.914	1.112	0.532	0.595	1.108
104.272	8.778	1.125	0.633	0.619	1.142
122.238	8.254	1.024	0.645	0.557	1.100
123.235	8.258	1.042	0.621	0.585	1.130
125.230	8.263	1.029	0.630	0.589	1.116
126.235	8.255	1.054	0.626	0.586	1.128

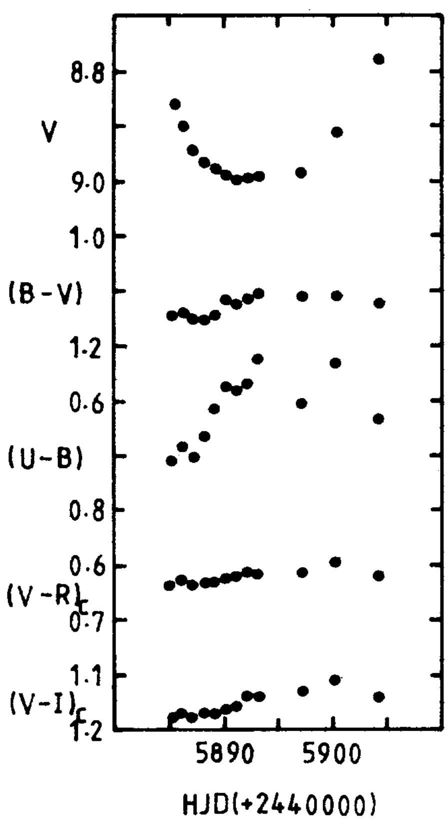

Figure 1: Light and colour curves for W Cru.

The results are shown graphically in Figure 1 for the period 2445885 to 2445904.

From our data, it appears that the primary eclipse is total in V, totality lasting at least three, and possibly as long as six days. The simple expedient of reflecting the points of the V light curve about a vertical axis of symmetry leads to our estimate of the time of mid-eclipse of 2445893.7 ± $0^{d}.1$ which yields an O-C = + $0^{d}.32$ with respect to the ephemeris given by Plavec (1984).

All colours become progressively bluer up to the time of mid eclipse, with (U-B) changing the most.

Apart from our discovery that primary minimum is total, our results appear to agree well with those of Marino, Walker and Herdman (1984).

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PHOTOMETRY SHOWING HD 219989 IS AN ECLIPSING BINARY

In this paper we present photoelectric photometry obtained at ten different observatories between 1974 and 1984 showing that HD 219989 is an eclipsing binary with an orbital period of $20^d.8529$, an Algol-type light curve, two eclipses approximately $0^m.55$ and $0^m.38$ deep in V, and a displaced secondary. The HD spectral type is A0 and the apparent visual magnitude is approximately $7^m.2$.

During the course of ubvy photometry of the eclipsing binary AN Andromedae Crawford (1975) discovered that his comparison star, HD 219989, was variable also. He continued photometry of HD 219989 itself, using BD $+40^o5046$ as a comparison star. On the night of August 10-11, 1974 the light dropped to $0^m.55$ fainter than normal in y, at a rate of $0^m.09$/hour. On the night of August 21-22, 1974 the light dropped to $0^m.38$ fainter than normal in y, at a rate of $0^m.05$/hour. From this he estimated JD 2442271.00 as a time of mid primary eclipse and 2442281.86 as a time of mid secondary eclipse. The depths and rates of light loss were similar in the other three bandpasses. On 20 other nights no eclipses were seen.

No further photometry of HD 219989 was obtained until it appeared on a list of bright suspected variables (Hall 1983) needing observation.

Ingvarsson found HD 219989 coming out of eclipse on two nights: October 31-November 1, 1983 and November 21-22, 1983. The slope indicated both were the rising branch of secondary eclipse; therefore, from the interval between overlapping portions, we could estimate the orbital period to be $20^d.86 \pm 0^d.01$. The observation by Boyd on the night of January 22-23, 1984 was, judging by its depth, virtually at mid secondary eclipse; the observation by Barksdale on the night of January 1-2, 1984 appeared to be on the falling branch of secondary very near the bottom. From those Boyd-Barksdale-Ingvarsson measures, we estimated JD 2445722.585 as a time of mid secondary eclipse. An earlier observation by Boyd in 1983 was, judging by its time and depth, near the bottom of primary eclipse. Recalling the

$10^{d}.86$ interval Crawford had found between primary and secondary, we concluded Boyd's measure was on the falling branch, rather than the rising branch. Then, recalling the $0^{m}.09$/hour slope Crawford had found for primary, we extrapolated to a depth of $0^{m}.55$ (assuming the depth to be identical in y and V) and estimated JD 2445711.73 as a time of mid primary eclipse.

The interval between the 1974 and 1983/84 times of minimum for primary eclipse was 3440.73, and for secondary eclipse was 3440.725, virtually the same. This interval is very nearly an integral multiple (164.94 ± 0.08) of the $20^{d}.86 \pm 0^{d}.01$ orbital period we had estimated from Ingvarsson's data. Therefore, using an exact 165 multiple, we took advantage of the 9.4-year baseline to derive an orbital period of $20^{d}.85290 \pm 0^{d}.00001$. The ephemeris we propose for primary minimum is

$$JD(hel.) = 2445711.73 + 20^{d}.85290\ n \qquad (1)$$

and note that secondary minimum is displaced, falling at phase $0^{P}.52$.

A list of the observers, their telescopes, and the number of different nights they observed is given in Table I. The data have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1982), where they are available as file no. 136 (Boyd) and file no. 53 (the other observers). All the differential magnitudes have been corrected for differential atmospheric extinction and transformed differentially to the UBV system. The light curve in Figure 1 is a plot of the ΔV magnitudes, where Δ is in the sense variable minus comparison, the comparison star being HR 8902. Each point is a mean of 2-to-6 individual differ-

Table I

Observers Providing Photometry of HD 219989

Observers	Observatory	Aperture	Nights
Barksdale	Barksdale	14-inch	12
Bisard	Brooks	14-inch	5
Boyd	Fairborn West	10-inch	15
Crawford	Ojai	24-inch	10
"	U.C.L.A.	16-inch	12
Heiser	K.P.N.O.	16-inch	3
Hoff	Hillside	16-inch	4
Ingvarsson	T.I.A.O.	14-inch	18
Persinger	E.T.S.U.	8-inch	6
Stelzer	Stelzer	14-inch	4

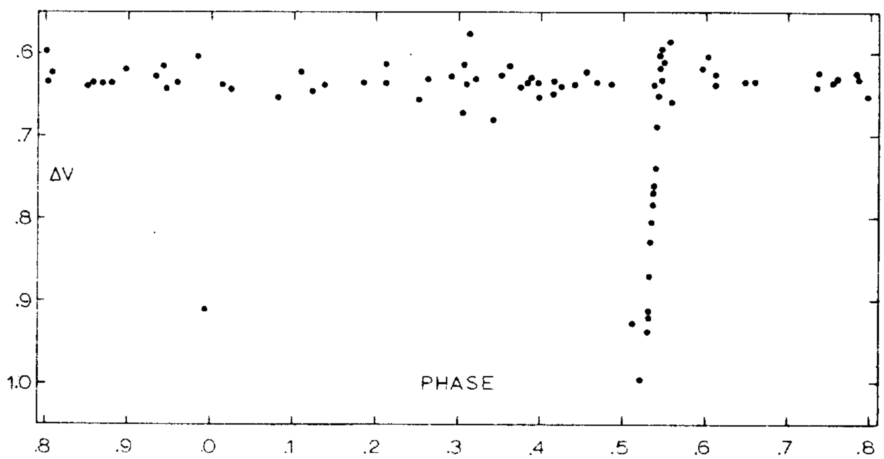

Figure 1

The light curve of HD 219989 in V based on the orbital period of 20.8529 days. Note secondary eclipse is displaced. The full depth of primary eclipse, not seen here, is 0.55 magnitude.

ential measures made on the same night, and phase has been computed with the ephemeris in equation (1). The differential magnitudes of Crawford, who used a different comparison star, are not plotted.

Of all four eclipse shoulders, fourth contact of secondary is defined best. Scrutiny of that shoulder indicates that the phase of external contact is approximately $0\overset{p}{.}015$. Thus the total duration of (either primary or secondary) eclipse, from first to fourth contact, is $D = 0\overset{P}{.}03$ = 15 hours. The displacement of secondary corresponds to $e \cos \omega = 0.03$.

It is ironic that in 1967 two other astronomers began a determination of the light curve of AN And using the same comparison star which Crawford used, namely HD 219989. It was explained by Tremko and Bakos (1978) that they made regular differential measures between HD 219989 and two check stars but found no indication that the former was variable. Indeed, their light curve of AN And showed only relatively small ($\sim 0\overset{m}{.}05$) photometric anomalies, certainly none which should have resulted from the relatively deep ($0\overset{m}{.}55$ for primary and $0\overset{m}{.}38$ for secondary) eclipses of their comparison star. A tally of the 72 nights they observed between 1967 and 1977 was published in Table 1 of Bakos and Tremko (1981). From this list we can compute phases with our ephemeris in equation (1). The results

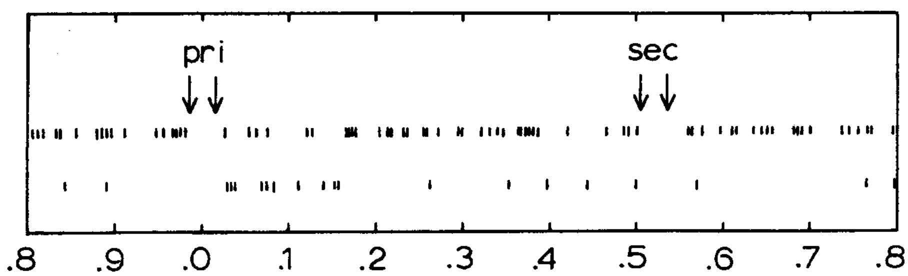

Figure 2

The 72 nights observed by Bakos and Tremko and the 20 nights observed by Crawford, when HD 219989 was NOT found in eclipse. Phases are computed with the ephemeris in our equation (1) and arrows mark the external contact points for primary and secondary eclipse.

are shown in Figure 2. It seems Bakos and Tremko were very fortunate. First, because of the Algol-type shape of the light curve of HD 219989, it maintains nearly constant brightness when it is NOT eclipsing, thereby serving as an adequate comparison star. Second, as Figure 2 shows, none of their 72 nights of observation fall within either primary or secondary eclipse. (For a binary which undergoes eclipse during 6% of its orbital cycle, anyone observing it on 72 randomly selected nights should have encountered it in eclipse on 4 or 5 nights; they were lucky not to have found it eclipsing even on one night.) The consistency implicit in Figure 2 is independent verification of the correctness of our ephemeris in equation (1).

Also plotted in Figure 2 are phases computed for the 20 nights in 1974 on which Crawford found HD 219989 not undergoing eclipse. This is additional confirmation of the correctness of our ephemeris in equation (1).

At Kitt Peak National Observatory on JD 2445593.7 Fekel obtained a spectrogram of HD 219989 and found the spectrum double-lined. The phase at that time, according to equation (1), was $0^{P}.34$, not far from quadrature. Spectroscopic observations obtained with the McDonald Observatory 2.1-meter telescope and coude spectrograph indicate a spectral type of A3 V for both components, with similar line strengths. The rotational velocities also are similar, with V sin i approximately 40 km/sec for each.

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ON THE He WEAK VARIABLE HD 28843

Photometric observations of HD 28843 (= HR 1441) in the *uvby* system have led to the derivation of a period of 1.37390 ± 0.00015 d (Manfroid and Mathys, 1984). The observations covered a time span of less than two years, from January 1976 to November 1977.

Contrarily to what was stated by Manfroid and Mathys, the star was already known as a variable as early as 1966 (Cousins, 1966). In fact, eight observations in the *V* band are available. These *V* data can be used to refine the period determination. *V* and *y* magnitude can be compared directly. Several frequency peaks are obtained when performing the analysis of the complete set of data, both by a Fourier–Deeming technique and by the method of minimization of the standard deviation of the observations from a least-square fit by a sine wave and its first harmonic (Mathys and Manfroid, 1984). Unlike the former, the latter method allows in the present case to determine unambiguously the best value of the frequency ($f = 0.727901 \pm 0.000006\,\mathrm{d}^{-1}$; the relevant part of the periodogram is shown on Fig. 1).

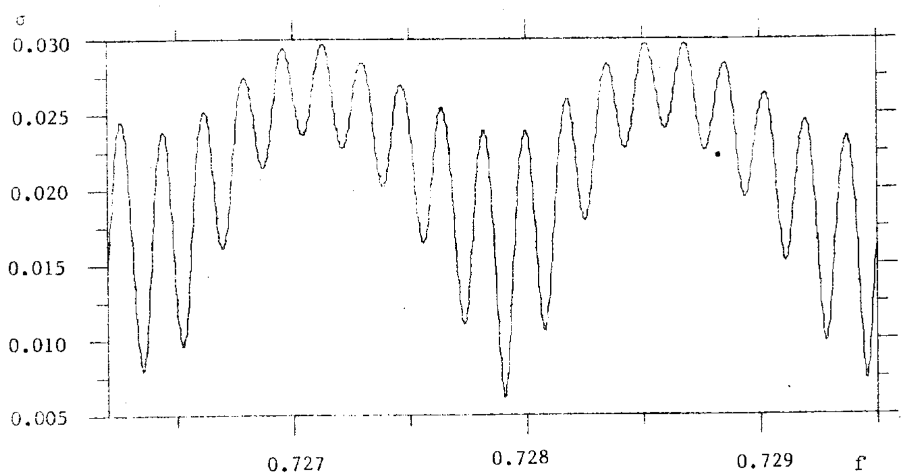

FIG. 1 — Part of the periodogram of HD 28843 showing the most probable values of the frequency

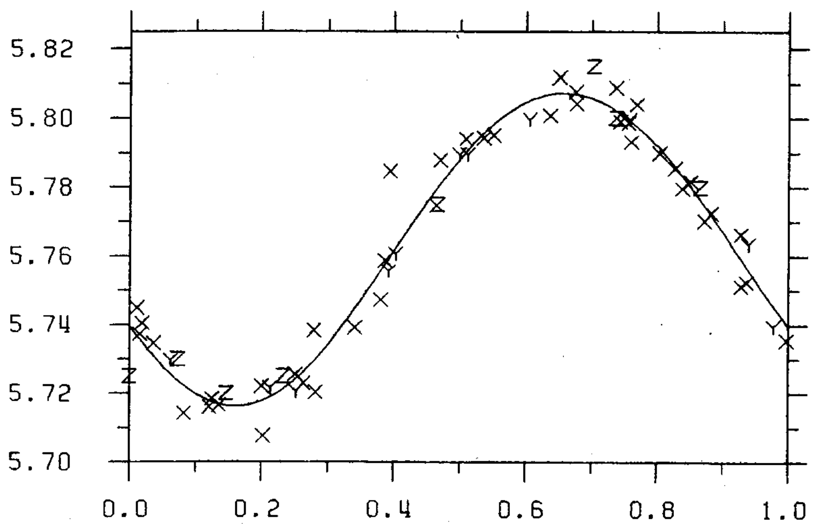

FIG. 2 — Phase diagram for HD 28843 with the period $P = 1.373813$ d. Phase origin is JD 2,437,647.336. The solid curve is a least-square fit of the observations by a sine wave and its first harmonic. Z: AWJC's 1966 V data. Y: Pedersen and Thomsen's y observations, January–February 1976 (Pedersen and Thomsen, 1977). X: JM and GM's y measurements, November 1977

A study of the phase diagrams confirms that the alternative values 0.726347 and 0.729453 d^{-1} are much less good. Hence we adopt

$$P = 1.373813 \pm 0.000012\,\mathrm{d}$$

as the most probable value of the period of HD 28843. The phase diagram obtained with that period is shown on Fig. 2, together with a least-square fit of the data by a sine wave and its first harmonic.

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A POSSIBLE DELTA SCUTI VARIABLE IN NGC 6405 *

During the photometric search for CP2 stars in open clusters (Maitzen, and Schneider, 1984) star no. 31 (number from Rohlfs et al., 1959) was found to be slightly variable. The observations were carried out during May 1981 with the ESO 50 cm telescope at La Silla, Chile. The Strömgren data, obtained during six nights, are as follows :

No	V	b-y	ml	cl	b	v	u	J.D.	phase
1	11.581	0.252	0.108	0.900	11.833	12.193	13.453	4739.64679	.00
2	11.625	0.252	0.165	1.011	11.877	12.294	13.722	4741.60126	.97
3	11.580	0.284	0.113	1.043	11.864	12.261	13.701	4746.73163	.03
4	11.631	0.263	0.161	1.021	11.894	12.318	13.763	4748.57666	.48
5	11.671	0.229	0.198	1.025	11.900	12.327	13.779	4748.71271	.61
6	11.679	0.213	0.187	1.020	11.892	12.292	13.712	4751.71008	.58
7	11.658	0.242	0.182	0.906	11.900	12.324	13.654	4751.88367	.58
8	11.574	0.263	0.165	0.958	11.837	12.265	13.651	4752.60559	.12
9	11.621	0.256	0.140	1.115	11.877	12.273	13.784	4752.70569	.49
10	11.584	0.306	0.041	1.109	11.890	12.237	13.693	4752.76788	.92
11	11.514	0.277	0.141	0.983	11.791	12.209	13.610	4752.86444	.15
12	11.538	0.297	0.088	0.980	11.835	12.220	13.585	4752.90723	.13

A straightforward sine fit through the data yields a period of 1.043 hours. This and the position inside the M_v-(b-y) diagram points to a possible δ Sct nature of this star (Breger, 1979), while the Δa photometry (Maitzen, Schneider, 1984) does not show any CP2 character (both, δ Sct and radially pulsating CP2 stars, occupy the same range inside the CM-diagram).
In Figure 1 the data for each Strömgren filter are plotted vs. the phase. The phases are calculated by using

$$\text{J.D.} = 2444739.64679 + 0\overset{d}{.}04346\ E$$

The amplitudes obtained from the sine fit are:

y : 0.09   b : 0.05   v : 0.07   u : 0.12   (mag.)

* Based on observations collected at the European Southern Observatory (ESO), La Silla, Chile

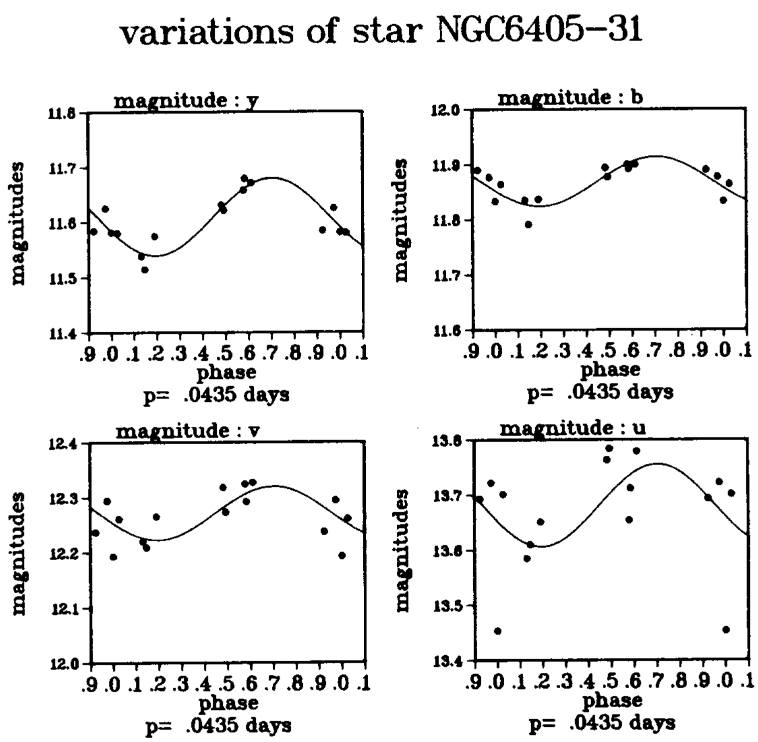

Figure 1

Because of the small aperture of the telescope and the relatively small brightness of the star the S/N ratio of the 120 second integrations is fairly small. This and the small sample of data causes greater uncertainties in determining the period, phase lag and amplitude. To obtain more accurate values of this object further observations are needed.

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PHOTOMETRIC OBSERVATIONS OF ACTIVE CHROMOSPHERE STARS:
II Peg, HD 175 742, HD 199 178

Photometric observations of three active chromosphere stars were carried out between August 17 and September 4, 1984 at the Ostrowik Station of the Warsaw University Observatory. Single channel photometer equipped with an uncooled EMI 6256A photomultiplier, attached to the 60cm reflector , was used. Differential observations were reduced to the standard UBV system.

1) II Peg

This often observed object belongs to RS CVn group. BD +28°4667 served as a comparison star. It was measured four times relative to BD +27°4648. Assuming for this star V=9.39 and B-V=1.02 (Bohusz and Udalski 1981) I obtained for BD +28°4667 V=8.24± 0.01 and B-V=0.76± 0.01. The differential observations, in the sense II Peg minus comparison star, are listed in Table I. The

Table I

JD 2445+	Phase	ΔV	Δ(B-V)
935.5688	0.590	-0.780	-0.269
935.5736	0.591	-0.757	-0.268
936.4611	0.723	-0.711	-0.268
936.4632	0.723	-0.696	-0.276
936.5396	0.735	-0.683	-0.287
937.4826	0.875	-0.636	-0.266
937.4875	0.876	-0.631	-0.269
937.5653	0.887	-0.649	-0.244
939.4590	0.169	-0.682	-0.321
939.5736	0.186	-0.683	-0.285
939.5771	0.186	-0.681	-0.293
940.3882	0.307	-0.688	-0.284
940.3951	0.308	-0.691	-0.286
940.3139	0.296	-0.696	-0.271
941.4701	0.468	-0.749	-0.260
941.4750	0.469	-0.755	-0.273
941.5514	0.480	-0.764	-0.233
948.5549	0.521	-0.757	-0.262
948.5618	0.523	-0.759	-0.249
948.5667	0.523	-0.761	-0.277
948.5701	0.524	-0.762	-0.256

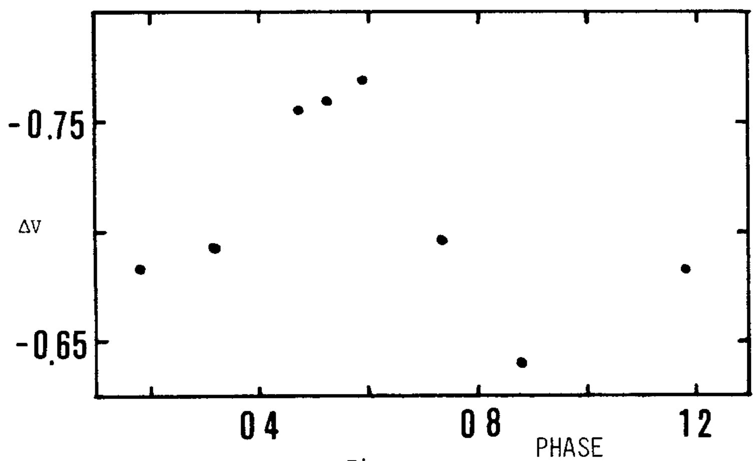

Figure 1

phases were calculated with the spectroscopic ephemeris (Vogt 1980): ϕ =JD 244 3033.47 +6.72422E. 7 nighly means in V are plotted in Figure 1. Although the light curve is not well covered, it is visible that the amplitude is about 0.12 mag. and the minimum is roughly near the phase 0.0.

2) HD 175 742

This star is classified as a BY Dra variable. It exhibits pronounced variations of light curve on a time scale of weeks (Bopp et al. 1984). The differential observations made relative to BD +24°3586 are given in Table II. The phases were calculated according to the ephemeris (Bopp et al. 1984): ϕ =JD 244 4338.94+2.900E. 6 nightly normal points are plotted in Figure 2.

Table II

JD 2445+	Phase	ΔV	Δ(B-V)
932.3424	0.449	-0.752	-0.193
932.3514	0.452	-0.759	-0.186
936.3271	0.823	-0.636	-0.175
937.3326	0.170	-0.682	-0.219
937.3431	0.173	-0.688	-0.208
939.3340	0.860	-0.618	-0.205
939.3424	0.863	-0.622	-0.211
940.3 49	0.195	-0.698	-0.203
940.3104	0.197	-0.702	-0.210
941.3208	0.545	-0.741	-0.181
941.3250	0.547	-0.733	-0.188

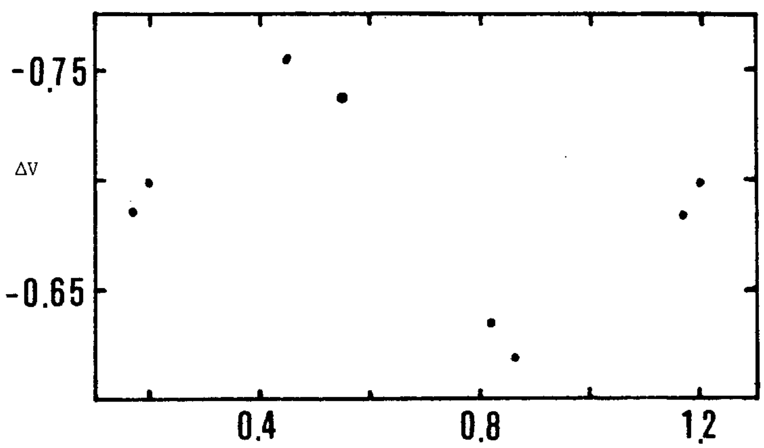

Figure 2

3) HD 199 178

According to Bopp and Stencel(1981) this star is a member of FK Comae class. Its photometric and spectroscopic observations were recently published by Bopp et al.(1984). The differential observations made relative to BD+43°3780 are given in Table III. The accuracy of individual observations is about 0.006, 0.008 and 0.018 mag. in V, B-V and U-B, respectively. These estimates are based on 7 observations of secondary comparison star, BD+42°3913. The U-B colour can be slighty affected by read leak which was not taken into account. The phases were calculated with the ephemeris (Bopp et al. 1984): ϕ =JD 244 4395. 70 +3.337E. The normal points in V based on two or more (with one exception)

Table III

JD 2445+	Phase	ΔV	Δ(B-V)	Δ(U-B)
930.3563	0.891	0.540	-0.306	
931.4285	0.212	0.620	-0.292	
931.4340	0.214	0.604	-0.274	-0.610
931.4458	0.217	0.604	-0.295	-0.577
932.3167	0.478	0.589	-0.290	-0.603
932.3264	0.481	0.565	-0.273	-0.621
935.3062	0.374	0.627	-0.289	-0.601
935.3125	0.376	0.607	-0.287	-0.606
935.3208	0.380	0.605	-0.288	-0.586
935.3868	0.398	0.602	-0.292	-0.596
935.3951	0.401	0.607	-0.305	-0.595
935.4007	0.403	0.579	-0.291	-0.618
935.5514	0.448	0.584	-0.297	-0.628
935.5590	0.450	0.618	-0.298	-0.606

Table III /cont./

J.D.2445+	Phase	ΔV	Δ(B-V)	Δ(U-B)
937.3236	0.979	0.577	-0.301	-0.571
937.4646	0.021	0.581	-0.281	-0.616
937.5535	0.048	0.576	-0.286	-0.572
936.3090	0.675	0.600	-0.307	-0.600
936.3167	0.677	0.577	-0.277	-0.619
936.4264	0.710	0.584	-0.291	-0.617
936.4903	0.730	0.573	-0.299	-0.614
939.3132	0.574	0.595	-0.290	-0.596
939.3222	0.578	0.588	-0.283	-0.607
939.4174	0.606	0.607	-0.304	-0.601
939.4910	0.628	0.591	-0.292	-0.593
940.3160	0.876	0.566	-0.305	-0.607
940.3236	0.878	0.560	-0.297	-0.580
940.4951	0.929	0.541	-0.288	-0.597
941.4479	0.215	0.605	-0.286	
941.5368	0.241	0.603	-0.286	
941.5403	0.243	0.593	-0.268	
941.5431	0.244	0.600	-0.279	

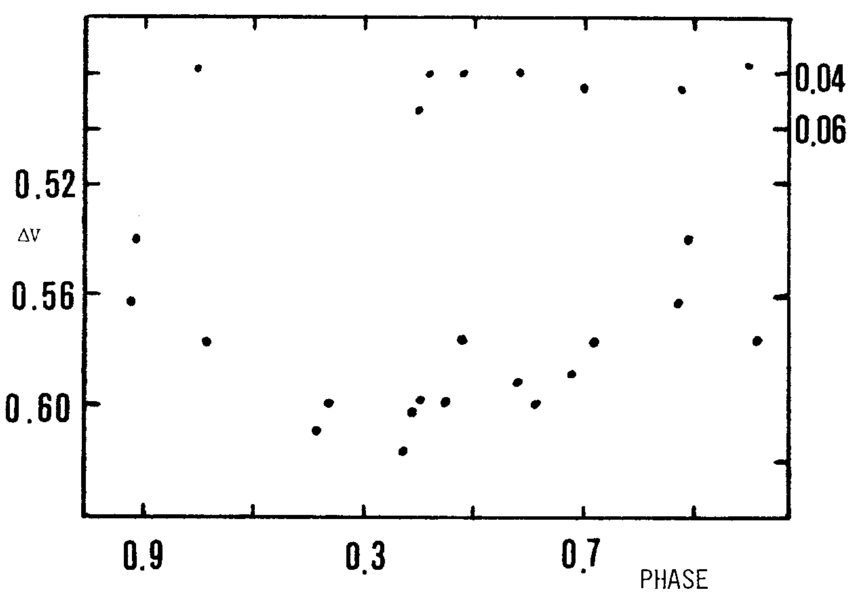

Figure 3

individual measurements are plotted in Figure 3. The upper pannel of this figure shows the individual differential observations of the secondary comparison in the sense c2-c1. One can see that V light curve of HD 199 178 has an amplitude about 0.06 mag.. The minimum is wide and seems to be located between phases 0.1 and 0.5. Inspection of Table III reveals that colour B-V is, on the average, bluer by about 0.02 mag. in the phase interval 0.5-1.1 than in the phase interval 0.1-0.5. Several authors reported flares of FK Com itself, best visible in U filter (Ruciński 1981; Morris and Milone 1983; Holtzman and Nations 1984). It seems that no flare with an amplitude larger than about 0.02 mag., was detected during the present observing run.

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IRC +10371, A NEW VARIABLE STAR

Inspection of several low-dispersion, blue-region, objective-prism plates has revealed an obvious variability of the red star IRC +10371 ($\alpha=18^h40^m10^s$, $\delta=+13^\circ58'.0$ -- 1950). The star was relatively bright on plates taken on Aug. 2, 3, and 5, 1970, but substantially fainter (probably 3/4 mag. or more) on one taken July 21, 1968. A chart for this object is provided by Wyckoff and Wehinger (1974), who have classified it M6 on a visual-region image-tube plate. It is no doubt a slowly variable M giant.

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Wyckoff, S. and Wehinger, P. 1974, Publ. Astron. Soc. Pacific 86,464.

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THE P-L-C RELATION OF GALACTIC FIELD CEPHEIDS AND THE P-L AND P-C RELATIONS OF OPEN CLUSTER AND ASSOCIATION CEPHEIDS

In our paper (Opolski and Ciurla, 1984) we have presented the arguments in favour of large value of the colour term coefficient in the P-L-C relation for galactic field Cepheids. As the continuation of this investigation one of us (T.C.) has worked out a modification of least squares and maximum likelihood methods, which seems to be the most suitable for calculating the P-L-C relation. In this new approach the log P is regarded as an accurate, faultless parameter and $M_{<V>}$ and $<B - V>_o$ as burdened with accidental errors. The details of this method will be published in a separate paper.

Using the data for 52 galactic field Cepheids published by Opolski (1982) (omitting 5 Cepheids which are suspected as overtone pulsators and 7 ones belonging to open clusters and associations), we got by means of this new method the P-L-C relation:

$$M_{<V>} = \underset{\pm 0.81}{5.40} <B - V>_o - \underset{\pm 0.84}{5.20} \log P - \underset{\pm 0.60}{3.44} \qquad (1)$$

or, considering that

$$<B - V> = <B> - <V> + 0.028$$

we have

$$M_{<V>} = 5.40 (<B> - <V>)_o - 5.20 \log P - 3.29 \qquad (2)$$

Here we have again the large value of the colour term coefficient, which supports our previous results.

In order to test the position of the open cluster and association Cepheids in relation to the plane determined by equation (2) in the three dimensional space: $M_{<V>}$, log P, and $<B> - <V>$ we have used the P-L and the P-C relations obtained for these stars by Fernie and McGonegal (1983):

$$M_{<V>} = \underset{\pm 0.10}{-1.61} - \underset{\pm 0.84}{2.882} \log P \qquad (3)$$

$$(<B> - <V>)_o = \underset{\pm 0.04}{0.32} + \underset{\pm 0.032}{0.418} \log P.$$

Geometrically the relations (3) can be treated as equations of a straight line in the same space. It is easy to verify that between the line (3) and the plane (2) there is a small angle amounting to only 9 $\pm$ 3 arcminutes and the line (3) intersects the plane (2) at the point: $M_{<V>} = -3.88$, $\log P = 0.79$ and $(<B> - <V>)_o = 0.65$, that is close to the mean position of the investigated field Cepheids. Taking into account the accuracy of these data, we may conclude that the line (3) is just placed on the plane (2) or that the open cluster and association Cepheids satisfy also the formula (2), though they do not determine any P-L-C relation, being placed along the line (3).

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UV CETI: SYNCHRONOUS UBV FLARE OBSERVATIONS

The results of the flare observations on UV Ceti carried out at the Maidanak station of Tashkent Astronomical Institute are presented. During the 94.25 hours of effective time of observations (1-14 August 1978, 20-29 September 1979, 24-27 September 1982) 14 flares were detected on UV Ceti (Melikian et al. 1979, Kiljachkov et al. 1979a, Kiljachkov et al.1979b, Melikian et al. 1981, Melikian et al. 1983). Some of them have been observed simultaneously in three colours U, B and V with the 60-cm and 48-cm telescopes. The description of the method and some characteristics of these observations can be found in Melikian's et al. (1979, 1981) papers.

The present paper includes the data of all observed flares (see Table I). In the columns of Table I the following data on flares are presented, respectively:

1. The serial number of the flare up in the given year;
2. The date of flare in UT;
3. Time of maximum in UT;
4. The rise time - t_1 in seconds;
5. The decay time t_2 in seconds;

6.-8. Amplitudes ΔU, ΔB and ΔV

9.-10. The $(U-B)_+$ and $(B-V)_+$ colours of the flare at the maximum, respectively.

The data presented in Table I show, that the average frequency of flares is about 1.1 flares hour^{-1} during these observations and that the $(U-B)_+$ and $(B-V)_+$ colours of the flares are very blue. Such blue colours were detected for the flares in stellar aggregates, associations and young stellar clusters (Mirzoyan et al. 1981, 1983).

Using the two component flare model, Kunkel (1967) showed, that after the maximum the flares have a slope

$$\frac{\Delta(U-B)}{\Delta(B-V)} \approx 0.3$$

Table I

The data of observed flareson UV Ceti

No	date of flare	time of max. (UT)	rise time t_1 s	decay time t_2 s	ΔU	ΔB	ΔV	$(U-B)_+$	$(B-V)_+$
1	02.08.1978	$22^h12^m42^s$	12^s	8^s	$1^m.53$	$0^m.39$	$0^m.10$	$-0^m.75$	$+0^m.30$
2	"	13 00	4	12	1.42	0.36	0.06	-0.70	-
3	04.08.1978	21 39 26	6	14	2.63	0.95	0.39	-0.77	+0.57
4	"	43 37	22	88	2.70	-	0.20	-	-
5	"	46 58	8	16	1.80	-	-	-	-
6	"	22 41 12	4	22	1.90	-	-	-	-
7	"	43 18	8	42	2.14	0.58	0.17	-0.96	+0.30
8	05.08.1978	23 13 46	6	14	3.50	-	0.40	-	-
9	07.08.1978	21 22 30	8	52	-	1.50	0.25	-	+0.80
10	"	22 26 08	18	160	-	1.40	-	-	-
11	"	29 10	20	30	-	1.10	-	-	-
12	09.08.1978	20 55 10	40	>70	3.72	1.93	0.56	-0.56	-0.31
13	"	58 32	102	3700	6.50	>4.30	3.20	-	-
14	10.08.1978	22 14 54	78	440	-	2.60	0.70	-	-0.75
15	12.08.1978	23 14 00	10	280	3.55	2.02	0.44	-0.28	-0.73
16	13.08.1978	21 29 15	30	150	2.92	1.63	0.37	-0.10	-0.40
1	20.09.1979	21 01 15	9	345	>3.49	2.20	0.94	-	+0.16
2	23.09.1979	19 00 32	14	105	1.51	0.37	0.24	-0.78	+1.31
3	"	23 53	14	793	4.03	1.94	0.88	-0.87	+0.35
4a	"	20 05 32	7	16	2.17	0.18	-	-	-
4b	"	05 58	9	9	2.11	0.20	-	-	-
4c	"	07 15	7	17	2.86	0.57	-	-1.79	-
4d	"	08 53	2	9	2.33	0.37	-	-1.77	-
4e	"	09 49	28	28	1.73	0.48	0.22	-0.72	+0.80
5	"	13 32	7	150	2.44	0.72	0.36	-1.00	+0.92
6	"	19 05	9	32	1.63	0.23	0.29	-1.52	+2.13
7	"	32 48	16	44	2.72	-	-	-	-
8	"	37 00	5	37	2.00	-	-	-	-
9	"	41 30	16	67	1.79	0.26	0.16	-1.59	+1.28
10	"	21 08 28	5	21	1.69	0.21	0.13	-1.74	+1.33
11	"	57 45	7	182	2.36	0.55	0.29	-1.29	+1.03
12	"	22 09 30	14	69	2.57	0.58	0.24	-1.40	+0.72
13	24.09.1979	19 11 40	2	12	2.27	-	-	-	-
14	"	15 47	2	12	1.49	-	-	-	-
15a	"	20 48 37	2	9	1.97	-	-	-	-
15b	"	49 32	2	9	2.60	-	-	-	-
16	25.09.1979	18 35 57	14	663	4.12	1.15	-	-2.2	-
17a	"	51 12	18	39	1.84	-	-	-	-
17b	"	52 49	7	23	2.34	-	-	-	-
18	"	19 25 37	14	21	1.53	0.16	0.06	-	-
19	"	51 14	2	44	-	0.32	0.18	-	+1.15
20	"	21 03 21	7	55	2.02	0.28	0.15	-1.79	+1.13
21	"	58 58	5	9	2.62	-	-	-	-
22	"	22 08 53	7	208	3.06	0.77	0.24	-1.57	+0.31
23	"	20 18	2	12	2.66	-	0.27	-	-
24	"	23 04 37	23	160	1.60	0.22	0.16	-	-
25	"	36 39	7	60	>0.97	0.36	0.19	-	+1.04
26	26.09.1979	20 11 15	9	81	1.97	0.32	0.22	-1.56	+1.38
27	"	21 13 00	5	65	3.27	0.93	0.33	-1.49	+0.58
28	"	22 55 21	14	30	1.41	0.20	0.13	-1.42	+1.38
29	27.09.1979	18 45 10	16	225	>1.30	0.79	-	-	-
30	"	19 05 46	12	60	1.48	0.25	0.07	-1.23	+0.43

Table I (cont.)

No	date of flare	time of max. (UT)	rise time t_1	decay time t_2	ΔU	ΔB	ΔV	$(U-B)_+$	$(B-V)_+$
31a	27.09.1979	$19^h26^m46^s$	9^s	83^s	$4^m.35$	$1^m.86$	$0^m.72$	$-1^m.29$	$+0^m.14$
31b	"	28 42	39	463	2.46	0.50	0.18	-1.50	+0.58
32	"	20 48 42	2	23	2.43	0.51	0.17	-1.47	+0.48
33	"	21 22 56	2	16	1.98	0.20	0.22	-2.14	+1.95
34	"	22 00 55	14	23	1.16	0.20	0.16	-1.06	+1.61
35	"	22 00	9	37	1.40	0.20	-	-1.40	-
36	"	23 30 32	2	14	1.85	0.23	-	-1.79	-
37	"	33 16	7	18	1.63	0.32	-	-1.13	-
38	28.09.1979	18 10 00	-	400	-	0.45	-	-	-
39	"	23 15	2	73	-	0.35	-	-	-
40	"	59 56	7	37	2.54	0.66	0.23	-1.23	+0.62
41	"	19 06 42	2	14	1.79	-	0.22	-	-
42	"	15 56	18	26	2.03	0.52	0.18	-1.00	+0.53
43	"	20 13 30	7	44	2.88	0.83	0.28	-1.22	+0.35
44	"	21 28 32	7	60	1.70	0.16	0.13	-2.04	+1.63
45a	"	47 33	5	5	2.32	-	-	-	-
45b	"	47 40	2	20	3.05	-	-	-	-
46	"	56 32	7	60	2.06	0.23	-	-2.04	-
47	"	59 42	5	91	3.33	0.96	0.37	-1.51	+0.50
48	"	22 02 39	7	192	4.81	1.96	0.83	-1.64	+0.24
49a	"	27 05	16	>30	1.89	0.44	0.39	-1.00	+1.70
49b	"	29 10	108	800	2.23	0.58	0.54	-1.10	+1.70
50	"	23 34 35	16	127	-	0.60	-	-	-
51	29.09.1979	20 05 00	7	25	-	0.26	-	-	-
1	24.09.1982	21 54 23	7	23	1.82	-	-	-	-
2	"	22 38 02	5	72	2.54	-	0.28	-	-
3	"	43 18	5	23	1.82	-	-	-	-
4	"	55 11	2	30	2.02	-	-	-	-
5	"	23 34 30	30	120	2.10	0.58	0.32	-0.90	+1.05
6	"	38 18	2	23	1.45	-	-	-	-
7	25.09.1982	21 20 52	2	23	4.47	-	-	-	-
8a	"	39 11	7	46	2.56	0.64	0.24	-1.30	+0.60
8b	"	40 07	2	60	2.63	0.60	0.19	-1.50	+0.40
9	"	22 09 11	5	23	1.53	0.24	0.15	-1.40	+1.30
10	"	33 11	14	30	1.67	-	-	-	-
11	"	23 11 16	9	30	1.72	0.49	0	-0.70	-
12	26.09.1982	21 02 11	2	30	2.05	-	-	-	-
13	"	06 07	5	120	1.10	-	-	-	-
14	"	43 11	5	55	2.22	0.64	0.24	-0.90	+0.60
15	"	22 34 11	5	23	2.08	-	-	-	-
16	"	40 18	32	72	1.96	0.32	-	-1.50	-
17	"	23 07 16	5	23	-	0.20	-	-	-
18	27.09.1982	20 15 16	14	120	1.70	0.33	0.05	-1.20	-
19	"	21 49	5	200	1.51	0.36	0.26	-0.80	+1.40
20	"	55 41	2	23	1.66	-	-	-	-
21	"	21 05 44	2	28	1.45	0.13	0.08	-2.10	-
22	"	22 11 26	2	23	1.89	-	-	-	-
23	"	16 44	2	67	2.29	-	-	-	-
24	"	59 11	7	46	2.90	1.16	-	-0.70	-
25	"	23 04 00	5	120	2.93	1.15	0.46	-0.08	+0.50
26	"	10 16	5	46	4.36	-	-	-	-
27	"	21 16	2	23	2.10	0.66	0.34	-0.70	+1.00

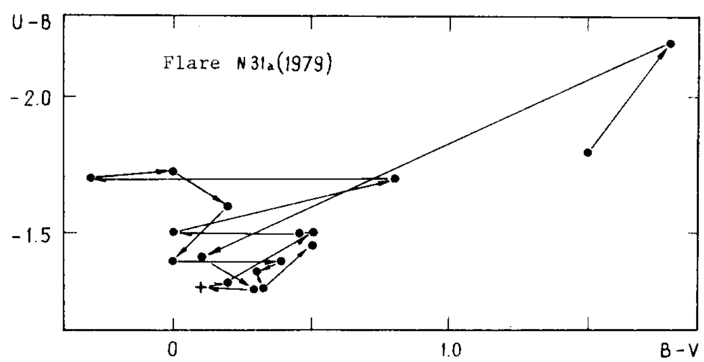

Figure 1

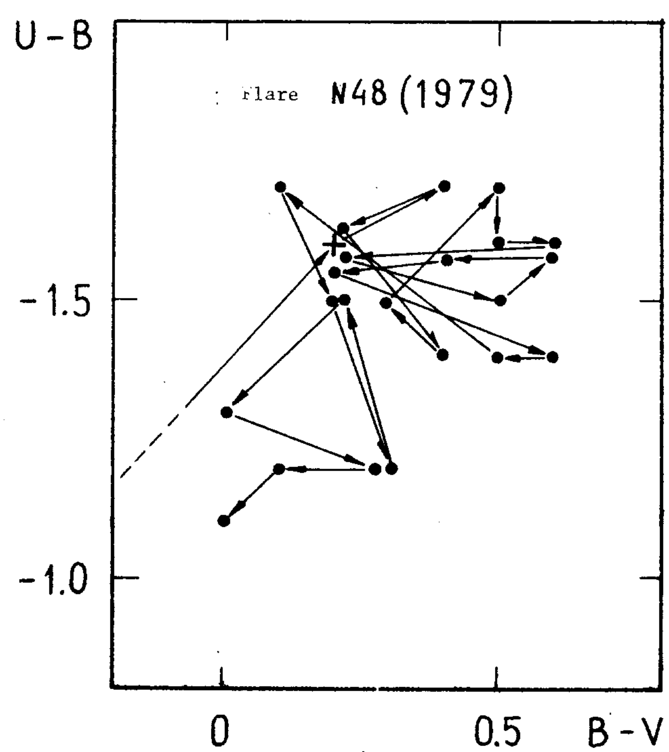

Figure 2

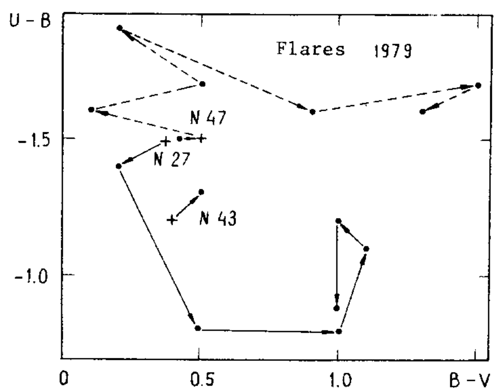

Figure 3

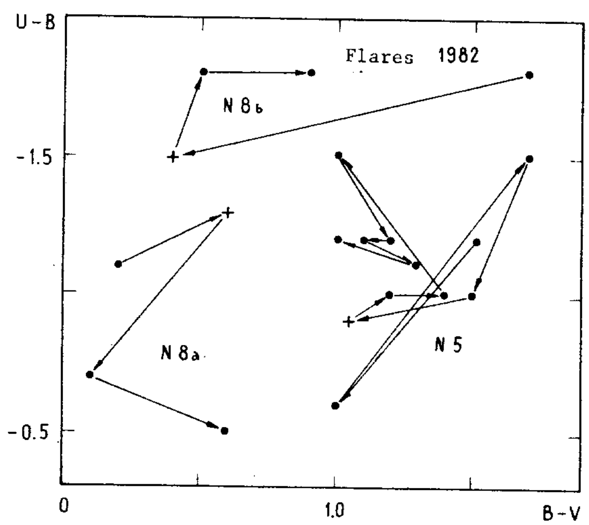

Figure 4

on the two-colour diagram (U-B, B-V).
From the other hand Cristaldi and Longhitano (1979) pointed out that during the flares the flare colours were constant.

On the basis of results of our first synchronous UBV flare observations on UV Ceti, it was shown that there was no certain direction for flare trajectories on the two-colour diagram (Kiljachkov et al. 1979b). In the present paper in the Figures 1-4 the trajectories on the two-colour diagram for 8 flares on UV Ceti are presented. These figures show, that a) on the two colour diagram the flare trajectories have various directions, and b) the flare colours during the flare are not constant. The same results were obtained for flare stars in the stellar aggregates (Mirzoyan et al. 1981, 1983) on the basis of synchronous UBV flare observations.

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NEAR-INFRARED LIGHT ELEMENTS OF 13 VERY COOL MIRA VARIABLES

Near-infrared narrow-band photoelectric photometry of unidentified sources in the Two Micron Sky Survey ("IRC") has led to the discovery of 13 new Mira variables. The observations were made between 1969 and 1975. These stars all attain photometric spectral types later than M9.5 at minimum light, which makes them the coolest Miras known whose photospheres are directly observable. Their mean periods and amplitudes at 1.04 μ substantially exceed the mean amplitudes and periods of previously observed visually bright Miras that reach M9.5 (Lockwood 1985). Light elements at 1.04 μ and observed characteristics of these stars are given in Table 1.

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Reference: Lockwood, G. W. (1985). Astrophys. J. Suppl., in press.

Table 1. New Mira Variables.

Designation	IRC	α(1950)†	δ(1950)†	I-K	104 max	104 amplitude	V max	V amplitude	Spectral type	Period	Adopted epoch	n
	-30023	$2^h35^m08^s$	-27°11ʹ.4	5.22	$2^m.53$	$1^m.84$	$9^m.8$	$5^m.0$	M7.8-10.1	$480^d±30$	2,441,340	5
	-30217	14 10 37	-29 40.5	5.20	1.46	1.46	12.1	3.7	M8.6-10.1	450±20	2,442,566	11
	+00102	6 19 22	-3 50.3	6.59	6.10	2.39	-	-	M8.0-10.7	490±20	2,441,125	10
	+00266	15 26 17	+3 59.8	5.45	5.28	1.65	13.1	-	M6.5-9.9	470±20	2,441,737	14
V2108 Oph	+10322	17 11 56	+8 59.3	6.31	3.85	2.25	13.6	-	M8.5-10.2	580±30	2,441,834	13
V1111 Oph	+10365	18 34 59	+10 23.0	6.08	2.99	1.76	11.8	3.6	M8.9-10.4	460:	2,441,402	5
	+10525	22 59 37	+10 20.0	5.73	4.92	2.20	14.5	-	M8.4-10.3	520±30	2,441,251	8
	+30021	1 08 30	+30 22.0	6.10	5.29	2.83	14.7	-	M8.5-11.0	560±20	2,441,655	20
V697 Her	+30292	16 25 59	+34 54.6	6.34	5.54	2.54	15.3	-	M8.5-9.6	520±20	2,442,566	12
KU And	+40004	0 04 17	+42 47.9	6.59	5.41	3.21?	15.2	-	M5.0-9.8	660:	2,442,345	
NV Aur	+50137	5 07 20	+52 48.8	6.57	9.73	1.04	-	-	M8.2-9.6	635*	2,441,221	6
	+60092	2 31 43	+64 56.6	5.47	4.82	2.21?	12.8	-	M8.4-10.3	600:	2,441,221	8
	+60169	6 30 02	+60 58.9	6.26	2.89	1.62?	10.9	3.8	M8.5-9.5	440±30	2,441,340	9

*Period from GCVS.

†Positions from the Two Micron Sky Survey.

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DISCOVERY THAT HR 454 IS A VARIABLE STAR

HR 454 was included in a list of twenty bright suspected variables (Hall 1983) after Bidelman (1983) reported observing strong Ca II emission and therefore suspecting it may be an RS CVn-type variable. According to the Yale Bright Star Catalogue the spectral type is gK1 and the apparent magnitude is V = $5^m.92$.

Altogether eight different observatories made photoelectric observations, mostly in V, on 107 nights between October 20-21, 1983 and March 23-24, 1984. The comparison star was 51 Andromedae, which is less than 20 arcminutes from HR 454 and differs less than $0^m.1$ in B-V color index. The nightly mean differential magnitudes, corrected for differential atmospheric extinction and transformed differentially to the UBV system, have been sent to the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1982), where they are available as file no. 136 (Boyd) and file no. 54 (the others).

The data in file no.136 were not corrected for dead time, because the dead time parameter had not yet been determined accurately. That may be a problem in this particular case because the comparison star is so bright (V = $3^m.6$) and the magnitude difference between it and HR 454 is so large (ΔV = $2^m.4$).

The nightly means in V are plotted in Figure 1. The magnitudes in file no. 136 appeared systematically $0^m.05$ brighter than the magnitudes in file no. 54 at corresponding times, we presume because of the above-mentioned dead-time problem. Therefore they have been plotted $0^m.05$ fainter.

In Figure 1 we see immediately that HR 454 is variable, with a total range of $0^m.09$, but the character of the variation is difficult to describe. Four minima are apparent (at JD 2445640, at 2445706, at 2445742, and at 2445782 or later) but the intervals between are definitely not equal. Moreover, there appears to be a secular brightening, at a rate of approximately $0^m.045$ / 100 days.

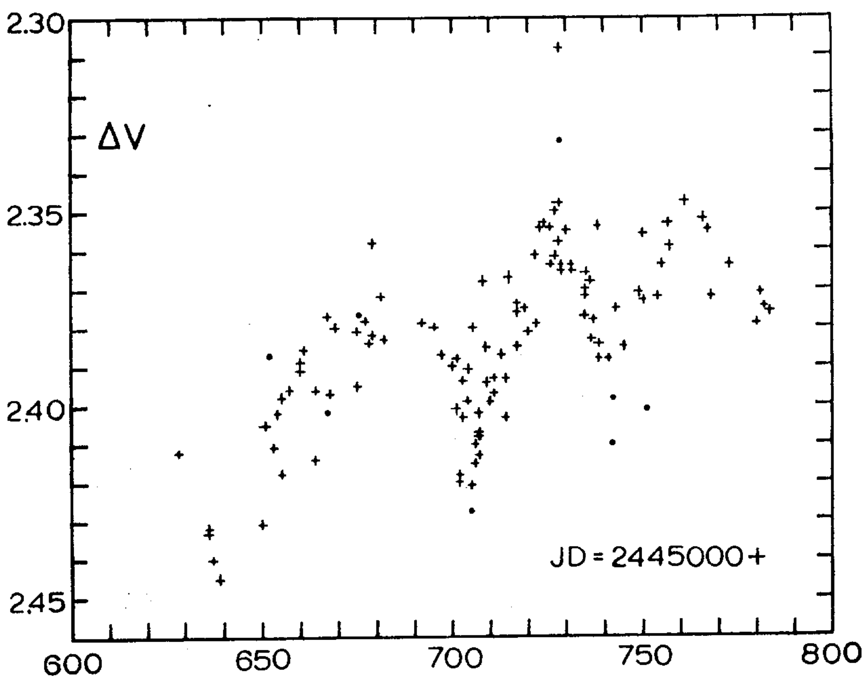

Figure 1

Our light curve of HR 454 in V, with 51 And as the comparison star. The total range seen in $0\overset{m}{.}09$, but no simple periodicity is evident. Each symbol is a nightly mean, with a distinction made if the uncertainty is less than (+) or greater than (•) ± $0\overset{m}{.}010$.

Table I

Observers Providing Photometry of HR 454

Observer	Observatory	Aperture	Nights
Barksdale	Barksdale	14-inch	18
Boyd	Fairborn West	10-inch	38
Chang	Riverdale	10-inch	3
Ingvarsson	Tjorn Island	14-inch	28
Persinger	E.T.S.U.	8-inch	6
Stelzer	Stelzer	14-inch	1
Wasson	Sunset Hills	8-inch	11
Ziegler	Gila	11-inch	2

We plan to continue photometry of this interesting bright variable, to see if there is a periodicity in the variation and to see if the secular brightening continues.

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References:

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A FAINT FLARE STAR IN VELA*

In a survey for flare stars in the young, sparse cluster IC 2391 (o Vel), we have found a strong flare of a very faint star not reported previously to have flared. The star is $1^\circ.7$ from the cluster center, however, and is unlikely to be a member.

It was found on two plates taken in the direct, multiple, ultraviolet-image manner with the Curtis Schmidt telescope at Cerro Tololo on 3 March 1984. The flare commenced between 1:45 and 1:55 UT during the ninth (last) 10 minute exposure on one plate, and the star is seen fading during all nine exposures on the following plate which cover the time interval 2:11-3:33 UT. (See Figs. 1 and 2 ; time increases to the right.) We estimate that the star was about 4 mag above the plate limit at maximum. Four other U plates exposed for a total of 5.5 hours in early March fail to show any trace of it. Its position relative to a grid of six nearby SAO stars is :

$$8^h39^m23^s.6, \; - 54^\circ \; 27' \; 09'' \; (1950).$$

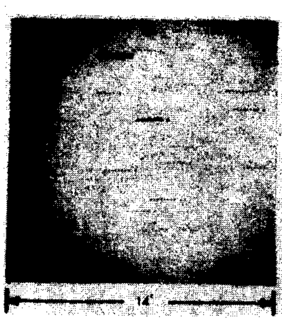

Figure 1

Figure 2

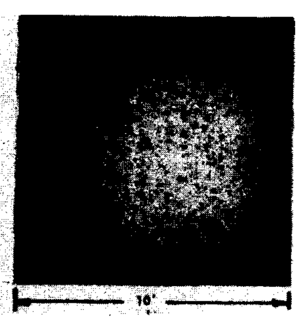

Figure 3

*Based on observations obtained at the Cerro Tololo Inter-American Observatory, National Optical Astronomy Observatories, operated by the Association of Universities for Research in Astronomy, Inc. under contract with the U.S. National Science Foundation.

It is not listed in the variable, proper motion, or nearby star literature. Fig. 3 is a finding chart copied from the SRC-J plate ; we judge the star to be about 1.5 mag above the plate limit or B~21 when quiescent.

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AM Cas - A DWARF NOVA
WITH A VERY SHORT CYCLE-LENGTH

This object was dicovered by Hoffmeister in 1928. Richter (1961, Veröff. Sternw. Sonneberg 4, 431) was the first who thought this object to be related to CN Ori, which is a well-known dwarf nova. On account of this supposal several slit spectrograms (image converter tube with UAGS) were gained in November 1983 during a full brightness cycle length at the 2 meter telescope of Karl Schwarzschild Observatory Tautenburg. They fully confirm that AM Cas is a dwarf nova belonging to the subclass Z Camelopardalis, with a very short cycle - length of only 9 days.

The minimum brightness is characterized by hydrogen emission lines (H_α line width about 3 nm), superposed onto a blue continuum. The weak excitation is remarkable in the spectra: apart from the hydrogen lines only traces of He I emissions can be established.

During the brightness eruption a nearly featureless blue continuum can be seen, where very weak H_α emissions are always present, but H_β is practically missing, eventually with a possible broad absorption.

A more comprehensive description of the spectral behaviour during a light cycle will be given elsewhere.

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STELLAR FLARES IN TAURUS

Systematic multi-exposed photographic observations of the aggregate in Taurus (see Hojaev, 1983) have been continued. The observations were carried out with the 21" and 40" Schmidt telescopes of the Byurakan Astrophysical Observatory in January-December 1982. We utilized ORWO ZU-21 plates without filter. The effective time of the patrol is equal to 284.9 hours.

The data concerning our observations are presented in Table I : the telescope used, the number of plates and exposures, effective time of observations and limiting magnitude of the plates.

Table I

Data concerning the observations

Telescope	Number of plates	Number of exposures	t_{eff}	m_{pg} lim.
21"	218	1253 ($1188\times 10^m + 65\times 7^m$)	$205^h\ 35^m$	17.0
40"	148	855 ($2\times 15^m + 2\times 10^m + 119\times 7^m + 6\times 6^m + 715\times 5^m + 11\times 3^m$)	$75^h\ 27^m$	17.5
Total	366	2108	$281^h 02^m$	

In addition, eleven direct plates of the observed region were also used ($T_{eff} = 03^h 52^m$).

Using these observations 32 flare stars and 37 suspected flares have been discovered the data on which are given in Tables II and III : Byurakan designation, coordinates for 1950.0, photographic magnitudes m_{pg} at minimum brightness, photographic amplitude of the observed flare Δm_{pg}, date of flare event, moment of maximum brightness (UT) and telescope. The stars showing brightness augmentation on two or more consecutive images (expositions) on our plates and having amplitudes more than 3σ (often not less than 5σ for the first of flare events) should be considered as certain flare stars. On the other hand the red dwarfs showing brightness augmentation of about 3σ, or a strong brightness augmentation on one exposition only, are considered as suspected flare stars.

Table II. New flare stars

B No	R.A.	Decl.	m_{pg}	Δm_{pg}	Date	UT_{max}	Telescope
12	$4^h34^m.8$	$+24°47'$	$15^m.5$	$1^m.4$	19. I.82	21^h28^m	21"
13*	38.9	+25 18	17.1	2.3	24. I.82	19 28	21
14	32.4	+26 36	18.5	3.2	10. II.82	16 59	21
15	40.8	+26 24	18.7	2.9	13. II.82	15 37	21
16	33.6	+26 36	16.6	1.9	21. II.82	17 45	21
17	24.3	+22 11	15.6	1.4	22. II.82	18 24	21
18	35.5	+22 00	16.2	1.1	25. II.82	16 13	21
19	31.4	+22 22	16.1	1.4	27. II.82	17 14	21
20	39.7	+23 23	17.1	1.6	14.III.82	17 35	21
21	31.5	+22 19	15.9	1.1	15. IX.82	22 24	21
22	30.4	+22 29	16.7	1.1	17. IX.82	23 59	21
23	21.2	+22 48	20.5	4.2	18. IX.82	00 53	21
24	31.1	+25 15	19.1	3.9	24. IX.82	20 34	21
25	27.1	+25 43	17.3	1.4	24. IX.82	23 47	21
26	23.5	+26 28	18.6	2.4	28. IX.82	22 37	21
27	39.4	+24 44	17.2	1.2	30. IX.82	00 41	21
28	30.7	+22 36	19.8	4.1	17. X.82	22 18.5	21
29	22.2	+21 56	16.2	1.4	22. X.82	20 57	21
30	23.3	+22 53	16.4	1.5	23. X.82	00 52	21
31	37.8	+22 46	17.2	3.6	25. X.82	21 17	40
32	23.8	+25 13	16.9	1.6	26. X.82	22 09	40
33	30.3	+24 16	17.2	1.2	26. X.82	23 31	40
34	24.6	+23 28	16.6	1.3	12. XI.82	22 23	40
35	33.8	+25 44	17.7	1.5	13. XI.82	22 28	40
36	26.8	+23 00	16.7	2.1	14. XI.82	20 22	40
37	25.6	+24 38	17.9	1.8	15. XI.82	00 35	40
38	27.8	+22 24	18.8	2.7	15. XI.82	00 45	40
39	23.6	+22 14	17.0	1.7	15. XI.82	02 10	40
40	31.3	+25 25	19.2	2.3	15. XI.82	20 16	40
41**	27.3	+25 03	16.0	1.5	15. XI.82	21 01	40
42	36.8	+23 49	17.3	1.3	17. XI.82	19 36	40
43	37.7	+22 57	16.4	1.3	18. XI.82	02 05	40

Remarks to Table II:

* LkH_{α} 332/ G2 – (Cohen and Kuhi,1979) member Trapezium type Triplet (Hojaev,1984

** Star had another flare (see Table IV) during our observations.

Table III. Suspected flare stars

SB No	RA	Decl.	m_{pg}	Δm_{pg}	Date	UT_{max}	Telescope
12	$4^h31^m.4$	$+23^\circ56'$	$16^m.5$	$0^m.9$	18. I.82	18^h23^m	21*
13	34.1	+26 30	15.8	0.9	19. I.82	21 38	21
14	31.7	+22 24	16.5	0.8	23. I.82	16 32	21
15	34.5	+24 01	16.9	1.9	23. I.82	18 05	21
16	22.2	+24 22	16.2	0.7	24. I.82	19 18	21
17	35.1	+23 54	16.0	0.8	13.II.82	15 52	21
18	31.1	+24 55	16.2	0.7	21.II.82	17 02	21
19	33.8	+25 51	16.7	1.3	22.II.82	18 44	21
20	37.4	+24 17	16.5	1.4	22.II.82	19 04	21
21	23.7	+24 45	16.0	0.7	24.II.82	18 11	21
22	30.4	+22 29	17.5	1.0	16.IX.82	00 40	21
23*	29.2	+23 46	16.7	0.5	16.IX.82	22 10	21
24	32.5	+26 03	17.2	0.6	17.IX.82	01 05	21
25	28.6	+25 27	17.3	0.7	18.IV.82	00 53	21
26	39.8	+25 59	16.4	0.8	20.IX.82	22 51	21
27	39.4	+24 17	16.8	1.0	24.IX.82	23 57	21
28	22.1	+23 58	17.2	1.0	28.IX.82	22 53	21
29	28.6	+25 24	16.6	1.1	28.IX.82	23 29	21
30	25.8	+24 21	16.7	0.8	12. X.82	20 44	21
31	25.9	+22 29	17.3	0.9	13. X.82	00 26	21
32	22.3	+23 49	16.6	1.1	13. X.82	21 46	21
33	30.5	+24 10	17.0	1.0	14. X.82	00 59	21
34	31.2	+23 30	17.3	0.6	17. X.82	21 27.5	21
35**	28.4	+25 39	17.3	0.9	12.XI.82	22 02	40
36	37.4	+24 37	16.1	0.6	13.XI.82	02 09	40
37	37.5	+23 16	15.6	0.7	13.XI.82	18 07	40
38	25.7	+24 58	16.7	1.0	13.XI.82	23 36	40
39	34.7	+23 49	15.2	0.5	14.XI.82	00 12	40
40	30.4	+23 22	16.2	0.9	14.XI.82	23 50	40
41	30.6	+24 23	16.0	0.9	15.XI.82	17 30	40
42	31.8	+23 44	16.3	1.0	15.XI.82	20 11	40
43	30.8	+24 42	16.5	0.8	15.XI.82	22 53	40
44**	35.8	+22 08	16.5	1.5	15.XI.82	23 45	40
45	28.2	+22 42	16.6	0.6	18.XI.82	00 31	40
46	26.7	+25 42	16.0	0.9	6.XII.82	16 11	40
47***	29.7	+24 51	14.2	0.8	7.XII.82	16 10	40
48	35.8	+23 20	16.4	1.0	8.XII.82	17 20	40

Remarks to Table III:

* Southern component of the variable star SVS 2159

** May be variable

*** Star No. 5 from Landolt's (1967) UBV standard sequence.

During our observations five repeated flares of known and above mentioned flare stars were detected , the data of which are given in Table IV. In the last column of Table IV the reference to the designation is given.

Table IV. Repeated flares

Star	m_{pg}	Δm_{pg}	Date	UT_{max}	Tel.	References
B4	$20^{m}.0$	$7^{m}.7$	17. I.82.	$16^{h}54^{m}$	21"	Hojaev, 1983
FH	16.2	1.3	26.III.82.	17 30	21"	Haro and Chavira, 1955 Huang et al., 1979
EZ	17.7	2.2	22. X.82.	23 40	21"	Haro and Chavira, 1955 Erastova, 1970
FI	17.8	1.4	25. X.82.	21 31	40"	Haro and Chavira, 1955
B41	16.0	1.8	7.XII.82.	17 34	40"	present paper

A more detailed analysis of our results will be published elsewhere.

Erratum : in the previous paper (Hojaev, 1983) the coordinates of the flare star B11 were given erroneously. The correct coordinates are as follows : R.A. = $4^{h}31^{m}.4$, Decl. = $21^{\circ}54'$(1950.0)

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NEW FLARE STARS IN TAURUS

After our previously published observations (Hojaev, 1983,1984) we continued the systematic search for flare stars in the Taurus dark clouds (TDC) region. The photographic multi-exposed observations were made with the 40" and 21" Schmidt telescopes of the Byurakan Astrophysical Observatory in pg-band (without filter) and with the 40" telescope in U-band (through a 2mm thick Schott UG1 filter) using ORWO ZU-21 plates. The patrol covered the period from January 1983 to April 1984 in the main. Several pg-plates obtained with the 21" telescope in 1980 ($t_{eff}=01^h30^m$) and U-plates obtained with the 40" telescope in 1981-82 ($t_{eff}=06^h45^m$) not used in our previous papers (Hojaev 1983,1984) were also included. Total patrol time is equal to 304.02 hours.

The data on the above-mentioned observational material (telescope, spectral band, the number of plates and exposures, effective patrol time and limiting magnitude on plates) are presented in Table I.

Table I

Observational Material

Telescope	Band	Number of Plates	Number of Exposures	T_{eff}	m_{lim}
21"	Pg	219	1322 ($1302 \times 10^m + 6 \times 7^m + 14 \times 5^m$)	218^h52^m	17.0
40"	Pg	85	480 ($3 \times 10^m + 20 \times 7^m + 450 \times 5^m + 7 \times 3^m$)	40^h41^m	17.5
40"	U	46	257 ($5 \times 15^m + 228 \times 10^m + 24 \times 5^m$)	41^h15^m	17.0 -17.5
Total		350	2059	300^h48^m	

In addition to the multi-exposed material, eight direct plates of the observed field with various exposure time ($t_{eff}=03^h13^m$) were also utilized.

33 new flare stars and 39 suspected flare stars were found. Data on these results are presented in Table II and Table III, respectively.

Table II

New Flare Stars in Taurus

No.	R.A.	Decl.	m	Δm	Date	UT_{max}	Telesc.
44	$04^h40^m.0$	$+23^\circ35'$	$15^m.7$pg	$1^m.5$pg	3. I.83	17^h49^m	21"
45	04 31.5	+23 53	17.2pg	2.2pg	3. I.83	18 39	21"
46	04 21.7	+23 41	20.0pg	5.6pg	9. I.83	19 57	21"
47	04 35.3	+22 58	15.3pg	1.2pg	10. I.83	17 23	21"
48	04 22.6	+22 42	16.5pg	1.5pg	10. I.83	17 33	21"
49	04 21.4	+26 08	16.8pg	1.6pg	10. I.83	18 54	21"
50	04 22.3	+24 10	20.0pg	5.7pg	12. I.83	22 38	21"
51	04 35.6	+23 37	18.0pg	2.0pg	13. I.83	16 12	21"
52	04 33.3	+23 23	16.0pg	1.9pg	2. II.83	18 36	21"
53	04 23.7	+22 24	16.9pg	2.2pg	7.III.83	15 53	21"
54	04 29.8	+22 13	16.7pg	2.0pg	11.III.83	18 17	21"
55	04 23.5	+22 26	16.9pg	1.7pg	6. IX.83	23 20	21"
56	04 24.2	+25 14	17.1pg	1.5pg	7. X.83	00 31	21"
57	04 41.2	+25 37	20.0pg	4.2pg	7. X.83	01 42	21"
58	04 33.4	+24 29	19.5pg	2.4pg	12. X.83	23 08	40"
59	04 30.0	+26 07	21.0pg	5.5pg	13. X.83	19 50	40"
60	04 31.9	+22 14	16.7pg	2.2pg	14. X.83	22 54	40"
61	04 30.4	+25 28	19.6pg	5.3pg	16. X.83	22 15	40"
62	04 24.7	+23 52	15.7 U	1.1 U	2. XI.83	21 57	40"
63	04 27.8	+22 48	15.6 U	2.5 U	3. XI.83	01 01	40"
64	04 38.4	+22 59	15.9 U	2.9 U	3. XI.83	02 15	40"
65	04 23.1	+23 58	16.3 U	1.4 U	10. XI.83	19 15	40"
66	04 36.7	+22 57	16.2 U	1.5 U	10. XI.83	19 25	40"
67	04 22.3	+23 27	17.2 U	1.7 U	10. XI.83	21 24	40"
68	04 23.7	+25 26	16.1 U	1.1 U	4.XII.83	21 19	40"
69	04 24.9	+23 55	17.0pg	1.3pg	5.XII.83	21 04	21"
70	04 38.4	+22 29	17.1 U	1.9 U	9.XII.83	20 40	40"
71	04 31.7	+24 40	18.8pg	3.8pg	11.XII.83	22 53	40"
72	04 31.8	+22 16	17.5pg	1.9pg	11.XII.83	23 43	40"
73 *	04 28.3	+24 05	16.1pg	2.1pg	14.XII.83	23 44	40"
74	04 34.3	+22 55	19.5pg	3.4pg	26.XII.83	15 31	40"
75	04 28.0	+24 44	18.0pg	4.3pg	26.XII.83	16 54	40"
76	04 30.9	+25 02	17.0pg	1.7pg	5. I.84	15 45	21"

* Lk Hα 331 (Herbig and Rao, 1972)

Table III

Suspected Flare Stars in Taurus

No.	R.A.	Decl.	m	Δm	Date	UT_{max}	Telesc.
49	$04^h30^m.8$	$+24^\circ47'$	$15^m.2$pg	$0^m.5$pg	10. I.83	$22^h58^m.5$	21"
50	04 26.1	+22 11	16.4pg	1.2pg	2. II.83	16 43	21"
51	04 32.9	+23 34	16.1pg	1.1pg	3. II.83	16 33	21"
52	04 33.8	+26 17	15.1pg	0.9pg	4. II.83	15 30	21"
53	04 30.3	+25 32	15.4pg	0.7pg	31.III.83	16 44	21"
54	04 32.1	+24 42	15.9pg	0.5pg	5. IV.83	16 59	21"
55	04 28.1	+23 56	16.1pg	0.7pg	5. IX.83	22 44	21"
56	04 26.6	+25 25	16.7pg	1.9pg	10. IX.83	23 02	40"
57	04 22.2	+23 51	16.9pg	1.0pg	10. IX.83	23 32	40"

No.	R.A.	Decl.	m	Δm	Date	UT_{max}	Telesc.
58	$04^h28^m.4$	$+22^\circ58'$	$16^m.9$pg	$1^m.3$pg	10. IX.83	23^h37^m	40"
59	04 24.3	+25 01	16.6pg	0.9pg	6. X.83	21 08	21"
60	04 33.7	+26 12	15.9pg	0.8pg	7. X.83	20 30	21"
61	04 27.7	+24 14	17.3pg	1.8pg	7. X.83	22 51	21"
62	04 39.4	+22 40	20.5pg	3.7pg	10. X.83	01 20	21"
63	04 33.6	+26 08	16.9pg	0.6pg	11. X.83	22 30	21"
64	04 22.2	+24 22	18.3pg	1.7pg	12. X.83	22 08	40"
65	04 35.8	+22 52	16.9pg	0.8pg	13. X.83	19 55	40"
66	04 26.0	+23 29	16.9pg	0.5pg	13. X.83	20 56	40"
67	04 22.4	+24 03	17.0pg	0.8pg	14. X.83	00 35	40"
68	04 22.3	+24 02	17.0pg	0.8pg	14. X.83	00 50	40"
69	04 32.8	+23 15	16.9pg	0.7pg	14. X.83	22 20	40"
70	04 31.4	+23 54	16.6pg	0.6pg	16. X.83	22 10	40"
71	04 26.0	+25 14	16.1U	0.9 U	2. XI.83	22 07	40"
72	04 28.8	+22 43	16.2U	0.9 U	5. XI.83	21 57	40"
73	04 29.1	+25 17	15.9U	1.0 U	13. XI.83	22 32	40"
74	04 29.2	+22 29	17.7pg	1.0pg	12.XII.83	22 59	40"
75	04 25.5	+23 56	17.2pg	1.8pg	13.XII.83	00 37	40"
76	04 22.3	+25 13	16.1pg	1.3pg	13.XII.83	00 47	40"
77	04 25.7	+22 28	15.8pg	0.6pg	15.XII.83	00 44	40"
78	04 37.5	+23 23	15.8pg	0.9pg	22.XII.83	15 08	40"
79	04 36.0	+24 22	16.7pg	0.8pg	23.XII.83	17 30	40"
80	04 26.6	+22 56	16.9pg	0.9pg	24.XII.83	17 05	21"
81	04 29.9	+24 03	16.9pg	0.7pg	25.XII.83	18 30	21"
82	04 30.1	+23 37	17.0pg	1.1pg	26.XII.83	20 39	40"
83	04 25.2	+24 08	17.1pg	1.5pg	4. I.84	18 12	21"
84	04 25.8	+24 06	16.8pg	1.0pg	6. I.84	17 42	21"
85	04 32.2	+22 33	16.9pg	1.3pg	23. I.84	20 03	21"
86	04 27.9	+24 17	16.7pg	0.8pg	24. I.84	17 18	21"
87	04 31.7	+23 45	17.0pg	0.8pg	24. I.84	18 20	21"

Successive columns of these tables give the following data:

1. Byurakan designation,

2-3. coordinates (1950.0),

4-5. magnitude at minimum and observed flare amplitude,

6-7. date of flare and moment of maximum brightness (UT),

8. telescope.

Seven repeated flares were detected on six known, newly discovered flare stars and suspected flare stars. Data on these events are summarized in Table IV.

Table IV

Repeated Flares in Taurus

Star	m	Δm	Date	UT_{max}	Tel.	Reference
B 4	20^mPg	4^m1Pg	9. I.83.	19^h17^m	21"	Hojaev (1983,1984)
SB42	16.3Pg	1.0Pg	7. X.83	23 33	21"	Hojaev 1984
B 27	17.2Pg	1.0Pg	11. X.83	23 30.5	21"	Hojaev 1984
SB65	16.9Pg	0.9Pg	13. X.83	21 11	40"	present paper
B 4	21.0U	5.8U	5. XI.83	20 42	40"	Hojaev (1983,1984) and present paper
SB38	16.7Pg	1.1Pg	25.XII.83	19 02	21"	Hojáev (1984)
EY	16.5Pg	0.7Pg	26.XII.83	15 36	40"	Haro and Chavira (1955)

Table IV contains data similar to those in Tables II and III omitting the coordinates. The references to the designation are presented in the last column.

Because the star B4 was fainter than the limit of our photometric U-plates its m_u was evaluated assuming U-B= +1.

At present the number of the known flare stars in the investigated region in TDS, is equal to 89. Seven flare stars showed 2 flares, two stars 3 and one star (B4) 4 flares. The lower limit of total number of the flare stars in this region estimated by Ambartsumian's (1969) formula is equal to 535.

The discussion on flare stars in Taurus will be published elsewhere.

The author is indebted to Dr.H.S.Chavushian for checking and confirming the above results.

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UBV LIGHT VARIATION OF THE WR STAR HDE 311884

The double-lined spectroscopic binary HDE 311884=MR 42 (2000.0 RA:$12^h43^m50^s.6$, DEC:$-63^\circ5'.3$) (Roberts, 1962) is a southern WR star of spectral type WN6+O (Smith, 1968) probably associated with the open cluster Hogg 15 (Moffat, 1974). It is a very massive system with minimum masses around 40 $M_\odot$ for the WN6 component and 47 $M_\odot$ for the unevolved early-type O companion (Niemela et al., 1980). In that work it was strongly urged that MR 42 be observed photoelectrically, so it was included among others, in a photoelectric broad band observing program designed to detect or confirm light variations in WR systems.

The purpose of the present paper is to report differential observations of HDE 311884 taken at CTIO in an 11 day observing run showing a light variation.

In 1981 the differential observations were done between August 15 and August 26 with the 61 cm Lowell telescope at CTIO. A standard one-channel photometer was used together with conventional UBV filters and refrigerated photomultiplier RCA 1P21. Three stars were used as comparison stars. They were selected close in the sky to MR 42 (about 3') and also close in the colors from previous absolute UBV photoelectric photometry of stars near and in Hogg 15 (Feinstein and Marraco, 1971, Moffat, op. cit., Muzzio et al., 1976). The comparison stars C1, C2 and C4 were numbered identically with those beginning with H in the work of Feinstein and Marraco (op. cit.). Each daily observation cycle consisted of the sequence

C1 - C2 - C4 - WR - WR - C4 - C2 - C1.

Each observation of the cycle was made in the typical symmetrical pattern V-B-U-U-B-V together with the associated sky background. The interval of time required for observing the whole cycle was about 40 minutes.
A diaphragm of about 15" was used. The sky measures were made as close as possible to the stars and every time in the same place. The hour angle of the observations was about 4 hours west. The data reduction process has been made both including and not including the first and second order extinction coefficients. The results never differed more than $0^m.005$. After subtracting the sky background the star counts were converted into magnitudes. The magnitudes were interpolated to

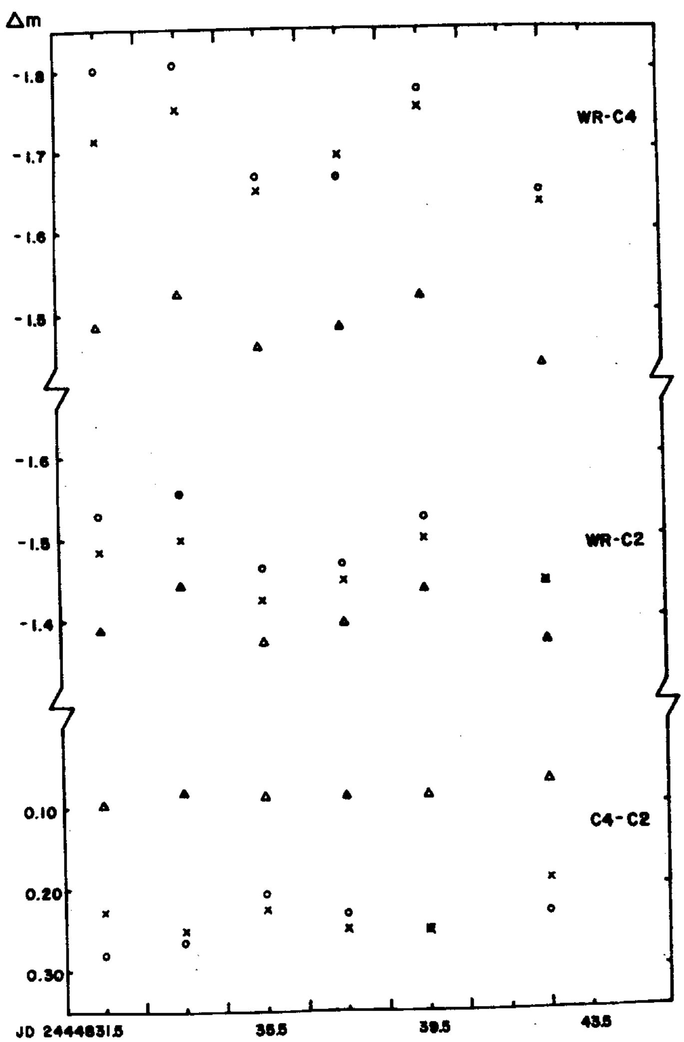

Figure 1

Differential observations of MR 42. Triangles, crosses and circles represent magnitude differences in V, B and U, respectively.

Table I

Differential Observations

JD (Hel.) 2440000+	Δv	Δb	Δu	Δb−Δv	Δu−Δb
WR-C4					
4831.5114	-1.484	-1.702	-1.790	-0.218	-0.088
4831.5152	-1.486	-1.723	-1.821	-0.237	-0.098
4833.5150	-1.525	-1.745	-1.811	-0.220	-0.065
4833.5190	-1.521	-1.755	-1.811	-0.235	-0.056
4834.9959	-1.458	-1.656	-1.679	-0.198	-0.023
4834.9997	-1.461	-1.641	-1.657	-0.180	-0.016
4837.4874	-1.481	-1.692	-1.680	-0.211	0.012
4837.4912	-1.491	-1.699	-1.659	-0.208	0.040
4839.4910	-1.513	-1.751	-1.778	-0.238	-0.027
4839.4945	-1.537	-1.763	-1.781	-0.226	-0.018
4842.4949	-1.459	-1.651	-1.673	-0.191	-0.023
4842.4989	-1.421	-1.629	-1.662	-0.208	-0.033
WR-C2					
4831.5114	-1.391	-1.473	-1.512	-0.082	-0.040
4831.5152	-1.394	-1.493	-1.542	-0.099	-0.050
4833.5150	-1.445	-1.494	-1.540	-0.048	-0.047
4833.5190	-1.446	-1.510	-1.568	-0.064	-0.058
4835.4959	-1.373	-1.427	-1.469	-0.055	-0.042
4835.4997	-1.379	-1.427	-1.459	-0.048	-0.032
4837.4874	-1.394	-1.443	-1.468	-0.049	-0.025
4837.4912	-1.409	-1.454	-1.464	-0.045	-0.010
4839.4910	-1.435	-1.499	-1.530	-0.064	-0.030
4839.4945	-1.447	-1.503	-1.521	-0.056	-0.018
4842.4949	-1.391	-1.460	-1.438	-0.069	0.021
4842.4989	-1.360	-1.438	-1.451	-0.077	-0.013
C4-C2					
4831.5075	0.095	0.227	0.276	0.133	0.049
4831.5179	0.093	0.228	0.279	0.135	0.051
4833.5109	0.086	0.258	0.301	0.172	0.042
4833.5216	0.073	0.241	0.228	0.168	-0.013
4835.4919	0.091	0.239	0.216	0.148	-0.024
4835.5027	0.079	0.208	0.196	0.129	-0.012
4837.4834	0.086	0.248	0.237	0.162	-0.011
4837.4938	0.085	0.247	0.223	0.162	-0.024
4839.4871	0.070	0.246	0.230	0.176	-0.016
4839.4970	0.095	0.264	0.276	0.168	0.012
4842.4908	0.067	0.196	0.263	0.129	0.067
4842.5014	0.066	0.187	0.195	0.121	0.008
C4-C1					
4831.5075	0.262	0.315	0.305	0.053	-0.010
4831.5179	0.277	0.339	0.387	0.062	0.048
4833.5109	0.124	0.218	0.266	0.093	0.048
4833.5216	0.197	0.250	0.225	0.053	-0.024
4835.4919	0.294	0.321	0.373	0.026	0.052
4835.5027	0.268	0.280	0.313	0.012	0.033
4837.4834	0.274	0.306	0.328	0.032	0.022
4837.4938	0.269	0.297	0.306	0.027	0.009
4839.4871	0.277	0.328	0.350	0.051	0.022
4839.4970	0.297	0.344	0.379	0.047	0.035
4842.4908	0.303	0.353	0.363	0.050	0.011
4842.5014	0.264	0.288	0.319	0.024	0.031

perform the following differences: WR-C4, WR-C2, C4-C2 and C4-C1. These values are listed in Table I. The daily mean values are displayed in Figure 1.

The differences C4-C2 show a dispersion typical of that folded in the light curves when observations of different days are grouped together in phase, though the dispersion in the U band is somewhat greater than expected, possibly due to the small number of the total star counts in that light (6000). On the contrary, the differences WR-C4 do establish a scatter that is three and two times greater than the normal dispersion in V, and B,U light, respectively. The differences WR-C2 are identical with the previous ones in the V band, while for B and U light are somewhat smaller, possibly due to the fact that comparison 2 is embedded in Hogg 15. The differences C4-C1 (not included in the figure) confirm the light variation of comparison 1 announced by Moffat (op. cit.) and Muzzio et al. (op. cit.).

It is concluded therefore, that MR 42 shows light variations with an amplitude about $0^{m}.1$ in UBV light. The trend of the photometric observations also suggests a possible orbital period of the system between 6 and 7 days which agrees with the value $6^{d}.34$ found from the velocity curves (Niemela et al., op. cit.). New photometric observations are needed to determine the shape of the light curve and to estimate the inclination of this very massive system.

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ON THE TIME DISTRIBUTION OF FLARES ON UV CETI

The statistical analysis of time distribution of stellar flares on UV Cet type flare stars was carried out by Oskanyan and Terebizh(1971) and by Lacy et al. (1976). Their investigations led to the result that the time sequence of flares had a nearly Poisson distribution which means that the distribution itself had a random character. Nevertheless, Oskanyan and Terebizh (1971) also pointed out the existence of a weak tendency that flares on UV Ceti occur in groups.

Recently Pazzani and Rodono (1981) found, that the time sequence of flares did not follow the Poisson distribution, and that the flare peaks and flare events showed a tendency to appear in groups.

In the present paper we used the results of synchronous photoelectric UBV flare observations on UV Ceti, carried out at the Maydanak station of the Tashkent Astronomical Institute, in the period of 1978-1982, simultaneously by three telescopes (Kilyackov et al., 1979, Melikian et al., 1981, Melikian et al., 1983). In this paper we present the results of our investigations of the time distribution of the UV Ceti flares using the observations, mentioned above.

The total observational time (94 hours and 15 minutes) was divided into 1131 and 283 parts. In the first case we got 5 minutes for one interval and 20 minutes in the second one. We calculated the number of intervals (n_k) with k (k=0, 1, 2,...) flare-ups. At the same time, we calculated the mathematical expectation values of the numbers of intervals (N_k) containing k(k=1, 2, ...) flare-ups assuming a Poisson distribution for the occurence of the flares. In calculating these quantities an average flare frequency, which was determined from our observational data as ν = 1.1 flares/hour, was used. The n_k and N_k values are shown in Table I.

Table I

k	n_k	$t=5^{min}$ N_k	n_k	$t=20^{min}$ N_k
0	1053	1031	224	195
1	57	95	33	72
2	18	4	16	13
3	2	0.1	8	2
4	0	0	2	0.1
5	0	0	0	0
6	0	0	1	0

The comparison of the n_k and N_k values shows that there exists a systematic discrepancy between the two series of data. The values of $n_k(k\neq1)$ are always larger than the values of N_k for the corresponding k $(k\neq1)$, while for k=1 the values of n_k's are smaller than their mathematical expected values for random distribution.

We determined the degree of agreement of the observed distribution of n_k's with that of N_k's with the help of the Pearson χ^2 criterion. We found, that the probability of agreement between the two distributions is lower than 0.01. The tendency of stellar flares to occur in groups is illustrated in Fig.1 , where the results of our flare observations on UV Ceti made in 1979 , are shown. The observational errors are as follows:

$\sigma\,/U/=0^m.15 - 0^m.30$, $\sigma/B/=0^m.3 - 0^m.07$, $\sigma\,/V/=0^m.04 - 0^m.09$

Our results show, that there is a marked tendency for grouping within 5 minutes as well as within 20 minute intervals. This means, that there exists a tendency for flares to develop very soon subsequently the previous flare. In our opinion this tendency can be interpreted in such a way that there exists a physical relation between the successive flares. We suggest as a probable model for the interpretation for the flare grouping the multiplicity of convective-explosion-generated phenomena (Grandpierre, 1984a, 1984b). In this model one convective explosion can lead to the generation of more than one flare occurring within some minutes. Accordingly, the members of a flare group are generated simultaneously. This process can be described as a twin-birth of flares. In this process not only one flare can be described as a twin-like in the case of sympathetic flares, but the convective explosion, which generates shock waves and high energy particle beams, can lead to a more or less simultaneous appearance of more than one flare.

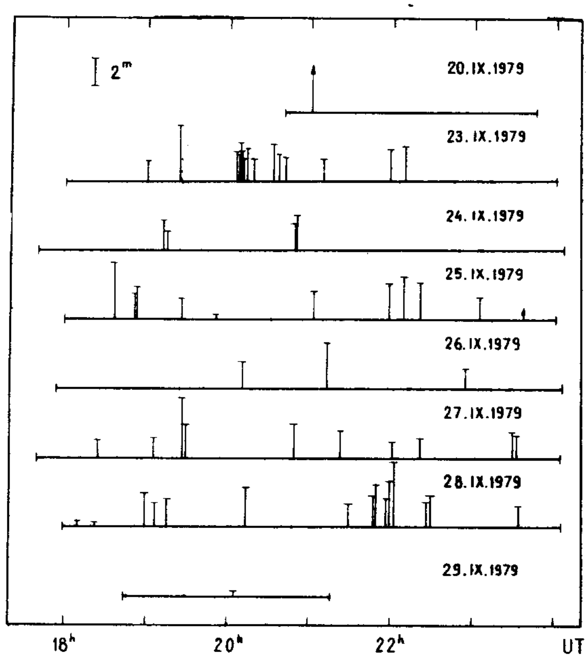

Fig.1. Time distribution of flares on UV Ceti. On the vertical axis the amplitudes of the flares are shown. Arrows at the photographic observations show that the real amplitudes are larger than the observed ones.

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B AND V PHOTOMETRY OF VZ Psc

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An observing history of the 0.261 day system VZ Psc can be found in Poretti (1984). The system's short period and late spectral type (K2-K5) make it an important late type contact system.

The system was observed on 4 nights between JD 2444808 and 2444813 with the #4 0.4-m telescope at KPNO using a dry ice cooled GaAs detector, BD + $4^{\circ}5016$ was selected as the comparison star. Each star was measured in the sequence VBBV, followed by a single V and B measurement of the sky. The comparison star was observed after every two variable star measurements. BD + $4^{\circ}5009$ was observed at least once each night as a check on the non-variability of the comparison star.

Phases were computed using the ephemeris of Eggen (1967). The light curve is shown in Figure 1. Calculations of times of minimum light were performed with the RAO's PHIMIN code which uses essentially the method of Kwee and van Woerden (1956). The resulting phases of minimum light are: $0\overset{P}{.}5226\pm .0032$ in V, and $0\overset{P}{.}5097\pm .0112$ in B, giving a weighted mean value of $0\overset{P}{.}5216\pm .0034$. Based on the light curve presented here, the minimum observed by Poretti appears to be the secondary, as he suspected.

Fourier analysis of the light curves showed that they could be accurately represented by a five term fit of the form:

$$\ell = A_o + A_1\cos\theta + A_2\cos 2\theta + B_1\sin\theta + B_2\sin 2\theta$$

The coefficients of the V and B full light curves, normalized to the weighted mean of the maxima are given in Table I, where the uncertainties in units of the last place are given in parentheses. The error of the fit, in magnitudes, is given in the last column.

The results of analyses on the full light curve, the maxima outside ± 0.1 of the minima, and the maxima outside ± 0.15 of the minima are not greatly different. This is what is to be expected for the light curve of an ellipsoidal variable.

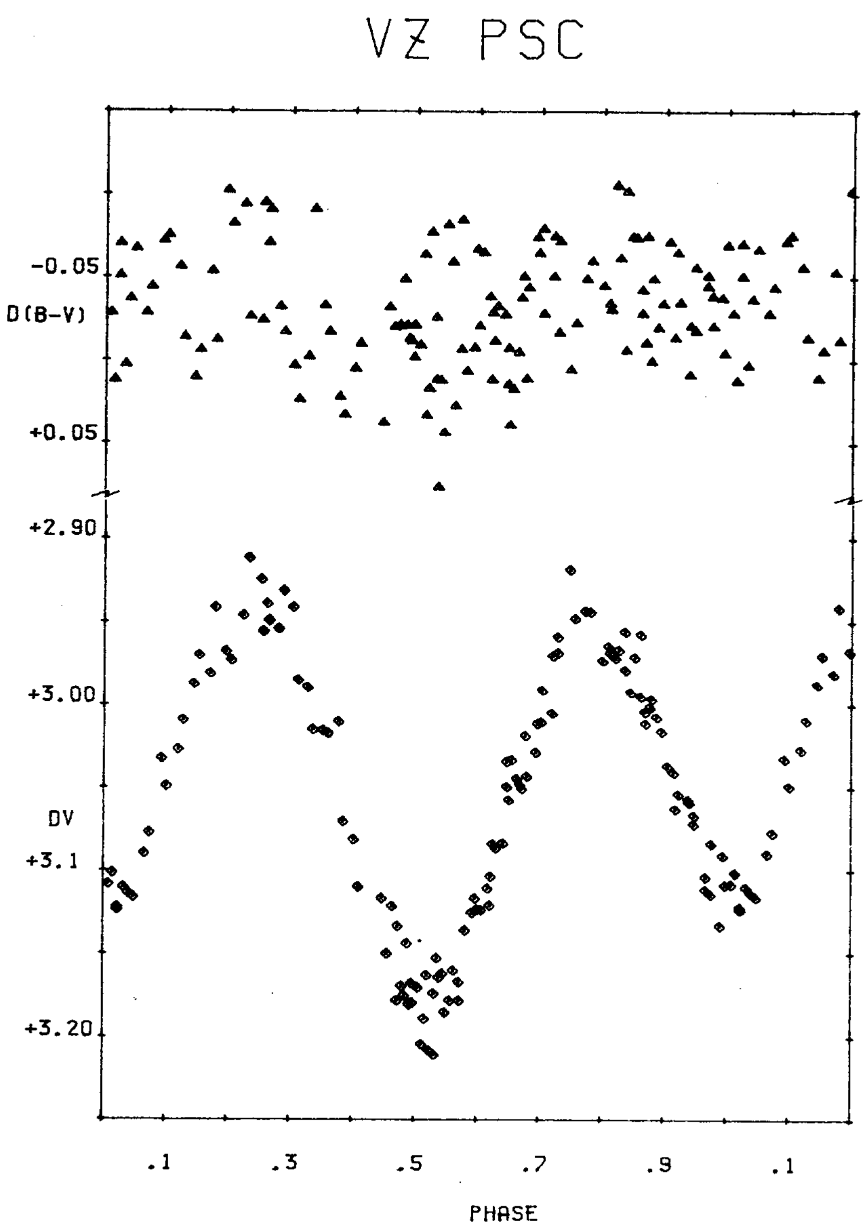

Figure 1

Table I

VZ Psc Fourier Coefficients - July 1981 Full Light Curves

	A_0	A_1	A_1	A_2	A_2	e
V	0.918(1)	-0.030(2)	-0.006(2)	-0.083(2)	+0.006(2)	±0.016
B	0.912(2)	-0.041(3)	-0.004(3)	-0.091(3)	+0.010(3)	±0.029

The system displays a marginal O'Connell effect (Davidge and Milone 1984)of 0.016 ± 0.012 in V and 0.039 ± 0.011 in B, based on means of the data in each maximum.

A detailed discussion of this and more recent photometry will appear elsewhere, and Hrivnak and Milone are preparing a radial velocity study for publication.

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A NEW PULSATING VARIABLE IN VELA

In April 1978 a new variable star was found at the European Southern Observatory, La Silla, among early-type stars in the field of planetary nebula NGC 3132. Further UBV measurements in 1979 and 1980 (50 cm and 1 m telescopes and pulse counting photometers with EMI 6256A photomultipliers) revealed this star to be a short-period pulsating variable. Stars in the E-regions (Cousins, 1973; Vogt et al., 1981) served as photoelectric standards.

The coordinates of the variable as well as of three comparison stars, measured on a Schmidt plate (ESO 100/162 cm Schmidt camera) are given in Table I. It also contains the UBV data together with their r.m.s. errors (n denotes the number of observations) and the estimated spectral types; the positions of the variable and of the comparison stars are marked on the finding chart.

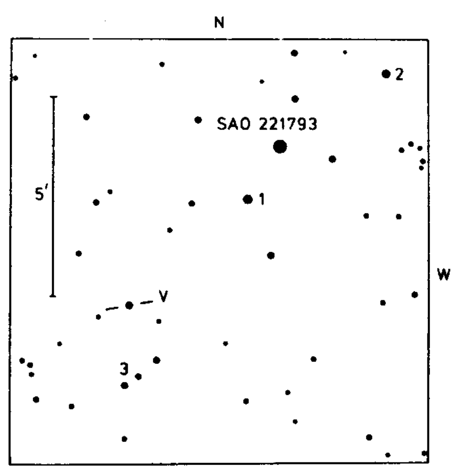

Figure 1

Table I

Positions, magnitudes and spectral types

Star	A.R. (1950)	Decl.	V	B-V	U-B	n	Sp
Var	$10^h05^m59^s.78$	$-40^\circ25'22''.3$	12.55	0.39	0.17	193	A8
Comp.1	05 43.55	22 50.9	10.986 ±.004	1.211 ±.007	1.072 ±.007	5	G8:
Comp.2	05 24.56	19 52.0	11.577 ±.002	0.553 ±.003	0.041 ±.005	24	F8
Comp.3	06 00.90	27 21.1	13.103 ±.002	0.629 ±.004	0.147 ±.006	7	G0:

Two objective-prism plates (ESO Schmidt camera, dispersion 450 A/mm at H_γ , Kodak IIa-O and IIIa-J, March 1978) show, that the spectrum of the variable is of type A8.

The light curve of the variable star can be approximated by a sine curve with the period of $P = 0^d.088$ days and the mean visual amplitude of $A_V = 0.07$ mag. The detailed analysis of the observing data including the more accurate determination of the pulsating period will be presented later.

I wish to thank H.-E.Schuster for taking the Schmidt camera plates, and H.-M.Steinbach for assistance with the reduction. The observations have been collected at the European Southern Observatory, La Silla, Chile.

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POSITION AND DISTANCE OF NOVA VULPECULAE 1984

The position of Nova Vul 1984 was measured on a plate taken with the new 60 cm Ritchey-Chretien f/8 telescope of the Hoher List Observatory. 18 AGK 3 stars were used. Third order terms were taken into account. The result,

$$\alpha_{1950} = 19^h24^m03^s\!.442 \pm 0^s\!.013 \qquad \delta_{1950} = +27^\circ15'54''\!.50 \pm 0''\!.26$$

is in good agreement with the results published by Argyle (1984) and Kosai and Huruhata (1984). As already noted by Shao (1984), the nova coincides with an oval object on the POSS, which is certainly a blend of several stars (see Fig. 1). Its minor diameter yields upper limits for the brightness of the prenova: $B=16^m\!.3$, $R=16^m\!.8$.

Furthermore, it was attempted to determine the distance and absolute magnitude of the nova. Two Cassegrain spectra (31 Å mm^{-1}), taken with the 1.06 m telescope of the Hoher List Observatory, were analyzed with the PDS 2020GM in Münster. The interstellar Ca II H line is severely blended with the stellar H and H ϵ absorption lines, the Ca II K line has an equivalent width of 0.39 Å. According to distance calibrations by Binnendijk (1952), Beals and Oke (1953), and Allen (1973), the distance of the nova is about 1.2 kpc.

The nova, whose galactic coordinates are $l = 61^\circ\!.098$ and $b = +5^\circ\!.197$, lies in field 267 of Neckel's and Klare's (1980) study of interstellar absorption. $A_V = 1^m\!.4$ can be assumed.

The maximum apparent magnitude, $m_V = 6^m\!.3$, thus leads to an absolute magnitude $M_V = -5^m\!.5$, somewhat fainter than the mean absolute magnitude of slow novae.

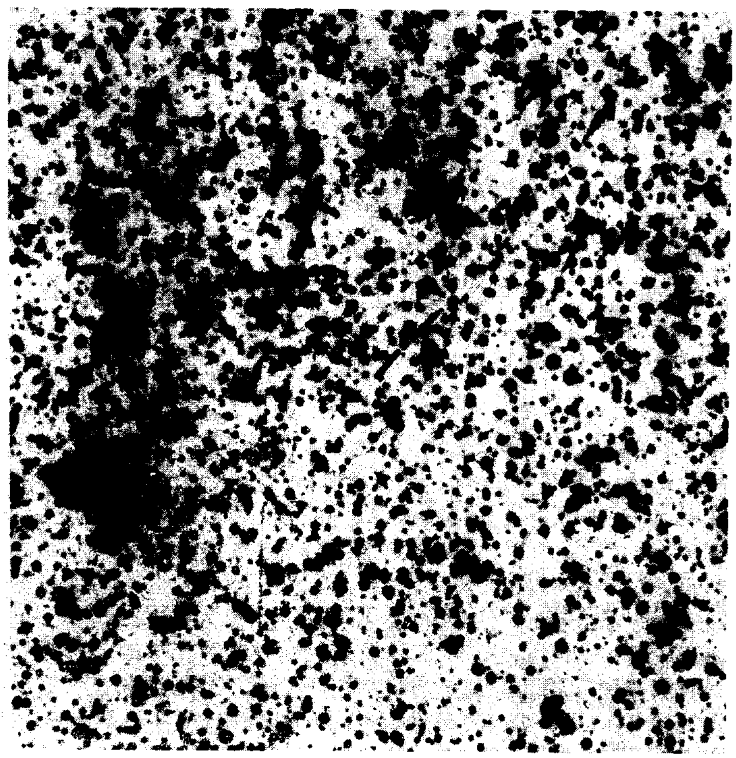

Figure 1
The field of Nova Vulpeculae 1984. The pernova is marked on this reproduction of the Palomar Observatory Sky Survey blue plate. The field size is 15'x 15', north is up.

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HD 208496 (HR8369): A DOUBLE - LINED ECLIPSING BINARY

In a recent IBVS, Manfroid and Mathys (1984) presented a partial light curve of HD 208496 (HR8369, m_V= 6.12, Sp = F3V), which the fourth edition of the Bright Star Catalogue (Hoffleit, 1982) mentions as a possible eclipsing binary. Manfroid and Mathys confirmed the eclipsing nature of the star and established an orbital period of 1.464047 ± 0.000011 days.

HR8369 was included in our radial velocity survey at ESO, La Silla, of previously unobserved stars in the Bright Star Catalogue. Two spectrograms were obtained in June 1983 with the ESO 1.5m telescope and coudé spectrograph (20 Å/mm). The plates immediately showed spectral lines of two components of rather similar spectral types, the lines of one component (the primary) being noticeably stronger and broader than those of the secondary. We estimate the rotational velocities to be rather large, 70 and 50 kms^{-1}, which explains why initial attempts to observe the star with the CORAVEL scanner were unsuccessful.

Radial velocity measurements of the two plates indicate a mass ratio of about 0.85± 0.05 and a systemic velocity around 40 kms^{-1}. Since Manfroid and Mathys gave no zero-point for their ephemeris, we cannot calculate the precise phases of our observations. If, however, we assume that the largest velocities measured approximate the maximum values, we derive masses of approx. 1.4 and 1.2 $M_{\odot}$. The observed rotations correspond to radii of the order of 2.0 and 1.5 $R_{\odot}$.

These figures are consistent with expectations for F3V stars, depending on the age of the system. However, being based on only two plates, they are obviously not by themselves of sufficient precision to add significantly to our knowledge of the absolute dimensions of early F stars. The purpose of this note is to point out that HR8369 is a bright system of favourable period which may yield good data if light and radial velocity curves are carefully determined, and to encourage such observations. Our own individual radial velocity measurements will appear in a catalogue to be published soon (Nordström and Andersen, 1984).

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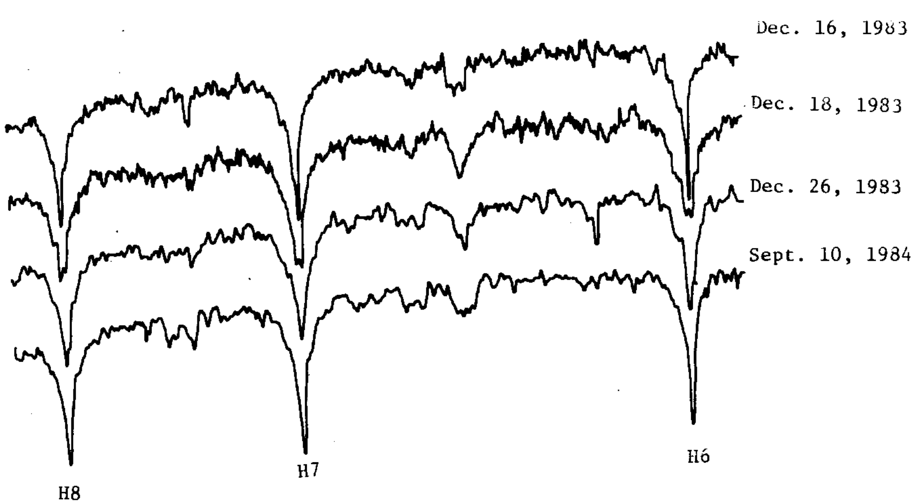
VARIATIONS IN THE SHELL SPECTRUM OF THE Be STAR EW Lac

We observed EW Lac with the grating spectrograph attached to the 60/90-cm Schmidt telescope of Beijing Observatory, giving dispersions of 50Å/mm and 86Å/mm. 22 spectrograms of this star were obtained from Sept., 1982 to Sept., 1984.

We found that the hydrogen shell lines on four spectrograms taken on Dec. 16, 18, 26, 1983 and Sept. 10, 1984, showed considerable variations. While the hydrogen shell lines were with single cores on December 16, 1983, these lines displayed double absorption cores on December 18, 1983, with the two components of nearly equal intensity. On a spectrogram taken on December 26, 1983, this phenomenon weakened considerably but was still apparent in H6-H10, and at the same time the R components became obviously weaker than the V components. On a plate taken on Sept. 10, 1984, these lines showed again sharper and deeper single cores as on Dec. 16, 1983 (see Fig.1.).



A portion of the density tracing of Balmer lines in four spectra of EW Lac
Figure 1

. Table I

Shell line velocities of EW Lac in km/sec.

Plate No.	Date		H5	H6	H7	H8	H9	H10	H11	H12
SA 1333	1983 Dec.16		-17.0	-12.0	-12.1	-4.2	-12.8	-20.2	-18.6	-10.2
SA 1334	1983	V	-155.5	-166.0	-166.9	-159.4	-171.3	-159.3	-204.6	-167.8
	Dec.18	R	- 23.2	- 20.0	- 21.3	- 10.3	- 18.6	- 15.4	- 50.2	- 11.5
SA 1371	1983	V	/	-108.5	-108.9	-112.3	-109.4	- 99.6	-108.8	- 89.6
	Dec.26	R	+ 14.1	+ 5.4	+ 17.9	+ 7.3	- 1.1	+ 15.1	- 1.4	/
SA 1427	1984 Sept.10		+ 7.6	- 17.9	- 21.6	- 19.0	- 4.4	- 17.8	- 29.5	- 23.1

We also measured the radial velocity of the shell lines H5-H12. The mean error in the velocity values is $\pm$ 3.9 km/sec. The results are listed in Table I. Our R component radial velocities are in agreement with the values of other authors derived from single cores. The V component radial velocities showed much larger variations than those of the R components from December 18-26, 1983.

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ON THE APSIDAL MOTION OF AG PERSEI

The apsidal motion of the detached eclipsing binary system AG Per was discussed by Martin (1938), Oosterhoff (1943), Ashbrook (1949), Morley (1966), Semeniuk (1968) and Güdür (1978). The period of apsidal motion was found to be 76.4 ± 0.5 years and 76.55 ± 0.05 years by Semeniuk (1968) and Güdür (1978), respectively.

We obtained two new photoelectric minima with the 48 cm Cassegrain telescope of the Ege University Observatory. An unrefrigerated EMI 9781A photomultiplier tube was used in conjunction with B and V filters which are very close to Johnson's standard system. These new minima are given in Table I together with the photoelectric ones obtained by Diethelm.

Table I

Times of minima of AG Persei

J D Hel.	Min.	Filters	O–C	E	Reference
24 44 634.352	II	–	0.030	9704	Diethelm, 1981a
925.392	I	–	–0.053	9848	Diethelm, 1981b
929.463	I	–	–0.039	9850	Diethelm, 1981b
45 271.382	II	–	0.039	10018	Diethelm, 1982
626.4097	II	B,V	0.0389	10193	This paper
984.3988	I	B,V	–0.0428	10370	This paper

The O–C values in this table were computed using the linear part of the following light elements given by Semeniuk (1968):

$$\text{Hel Min I J D} = 24\ 24\ 946.5153 + 2^{d}.02872963.E - 0^{d}.04517 \cos(60^{\circ}.8 + 0^{\circ}.02616.E)$$

$$\text{Hel Min II J D} = 24\ 24\ 947.5297 + 2^{d}.02872963.E + 0^{d}.04517 \cos(60^{\circ}.8 + 0^{\circ}.02616.E)$$

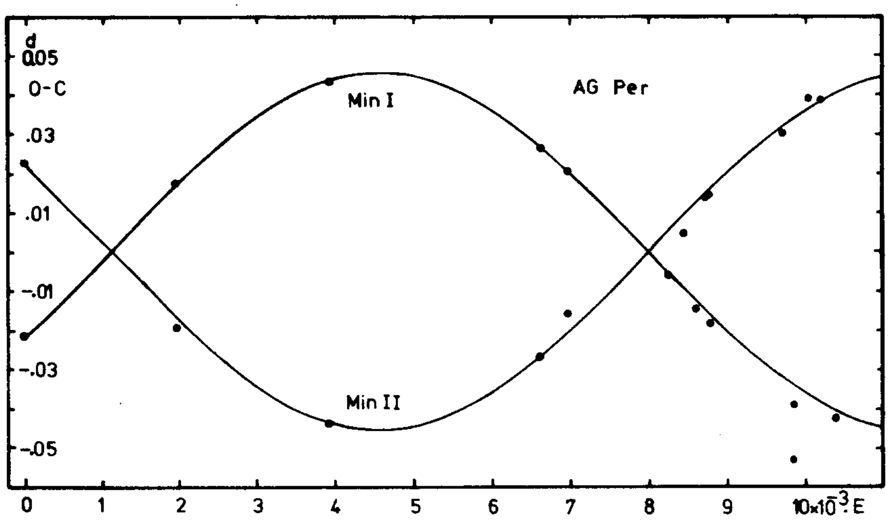

Figure 1. The O-C diagram for AG Per

They are also plotted in Figure 1, where the continuous curves represent the periodic terms in the epochs of minima. The other times of minima in this figure are taken from the literature (see Güdür, 1978).

The times of minima are in good agreement with the continuous curves in the figure. One of them, obtained by Diethelm, shows large deviation. This is probably due to an observational error. As a result, one can say that the new observations confirm the apsidal motion period of AG Per given by Semeniuk (1968) and Güdür (1978).

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DETERMINATION OF THE MAGNETIC FIELD IN THE STAR V 474 Mon

V 474 Mon (HD 40535) is a variable star of Delta Scuti type with the primary period of light variation P=$0^d.1361260$ showing the Blazhko-effect with Π = = $7^d.746 \pm 0^d.001$ (Romanov, Fedotov, 1979). Both the primary period and the Blazhko-effect period are exhibiting stability according to published observations. An abnormally great variation of light amplitude is present with the Blazhko-effect period: from $0^m.04$ to $0^m.36$ (Millis, 1973).

Spectral observations of this star were carried out with the second camera of the main stellar spectrograph of the 6-m telescope, SAO, Academy of Sciences, USSR, in September, 1982. Spectrograms of the stars α^2 CVn and β CrB were also obtained from 1980 to 1982. These magnetic stars have been investigated more completely and have been used as standards of magnetic field.

An achromatic analyzer of circular polarization with a Fresnel rhomb has been used as a phaseshifting element along with a crystal of Iceland spar which provide the 5" separation of circularly polarized light beams at the spectrograph slit (Glagolevsky et al., 1978). All the spectrograms were obtained with an inverse linear dispersion of 9 Å/mm. Time resolution used was 4-7 minutes for V 474 Mon and 1-3 minutes for α^2 CVn and β CrB. Kodak emulsion 103a0 hypersensibilized with hydrogen according to the procedure developed at the Odessa Astronomical Observatory has been used. The spectral interval of wavelength is 3900-5000 Å.

From 20 to 70 lines have been measured in each spectrogram in the spectral range 4000-4600 Å. Probable error of one measurement amounts to 130-280 gauss for V 474 Mon, 300-550 gauss for α^2 CVn and 100-300 gauss for β CrB. The determinations of magnetic field strength for α^2 CVn and β CrB agree with those of other authors in all phases.

Variation of the magnetic field strength for V 474 Mon are given in Fig 1. Phases of the fundamental pulsation period were calculated according to the ephemeris: Max hel. J.D. = 2441661.1668 + $0^d.13612600 \cdot E$ and phases of the Blazhko-effect in the star according to : J.D. max (O-C)=2441664.962+$7^d.74639 \cdot N$ (Romanov, Fedotov, 1979). These elements are in a good agreement with all known observations.

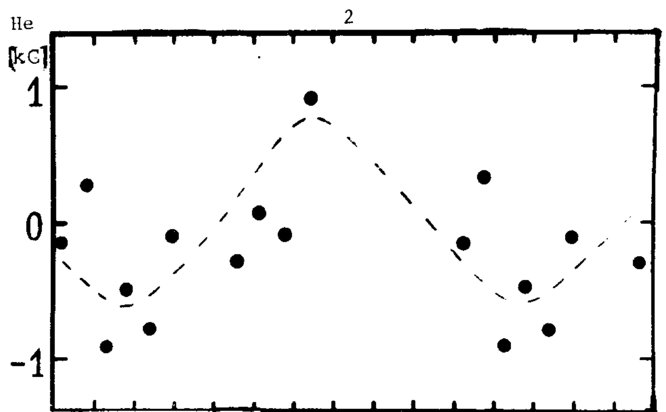

Figure 1

It is seen from Fig.1 that the magnetic field strength changes with the phase of stellar pulsation. The large scatter of points results from both errors of measurements and the Blazhko-effect process. The character of this variation is not yet found. It should be noted that not only the magnetic field strength changes, but also the field sign changes.

To solve the problems connected with pulsations and magnetic field variations further spectroscopic and photometric observations of V 474 Mon are extremely needed.

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PHOTOELECTRIC OBSERVATIONS OF R CrB

The rise from a recent deep minimum of RCrB was observed photoelectrically with the 165mm Newtonian reflector at Nessa Observatory using standard UBV filters. δ CrB (V=4.63, B-V = +0.80, U-B = + 0.37) and SAO 084005 (V=7.45, B-V=+0.44, U-B=+0.02) were used as comparison stars. These observations are the continuation of those published in IBVS 2442.

Table I. Photoelectric Observations of RCrB

J.D. 2440000+	V	B-V	U-B	J.D. 2440000+	V	B-V	U-B
5808.333	8.66			5918.375	6.68	+0.63	
809.346	8.43			925.354	6.63		
810.375	8.35			926.375	6.60	+0.78	
814.354	8.00			935.354	6.54	+0.66	
815.358	7.83			936.363	6.53	+0.86	
822.350	7.62	+0.52		940.338	6.53	+0.91	
828.375	7.23	+0.47		946.346	6.55	+0.91	
839.379	7.29	+0.55		947.342	6.53	+0.91	
851.396	6.74	+0.86		951.333	6.54	+0.89	
853.438	6.61	+0.81		962.313	6.49	+0.42:	
863.417	6.56			975.271	6.33	+0.90	
889.417	6.71	+0.98		989.250	6.43	+0.61	+0.26
891.404	6.66	+0.88		990.233	6.32	+0.80	+0.31
903.383	6.55	+0.84		991.250	6.41	+0.74	+0.16
905.396	6.60	+0.87		992.238	6.30	+0.63	
907.375	6.59	+0.81		994.288	6.19	+0.75	+0.41
911.396	6.63	+0.82		998.250	6.28	+0.59	+0.21
912.382	6.61	+0.77		6005.271	6.18	+0.59	+0.40
913.379	6.55			017.221	6.08:		

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PHOTOELECTRIC MONITORING OF BUTLER'S FLARE STAR

Butler's Flare Star (finding chart: Arp (1958), Plate 1, Star 'R') was discovered (Andrews, 1966) at Boyden Observatory during photo-electric observations of a "standard" star in the field of the Small Magellanic Cloud previously observed by Arp (1958), with further monitoring (Andrews et al., 1966) confirming UV Ceti-type flaring activity.

This activity was considered as extremely unusual as objective prism spectroscopy gave the spectral type as an early G-type star, later revised (Andrews, 1967) by slit spectroscopy to dK0 with no trace of emission lines in the spectrum.

As this classification is earlier than any solar neighbourhood flare star listed by Pettersen (1977), and no report of monitoring since 1966 has been published, it was decided to investigate the variability of Butler's Flare Star to determine the rate and photometric characteristics of any flaring activity.

Butler's Flare Star was photoelectrically monitored in the Johnson 'B' band with the Nishimura 0.41 m reflector at Boyden Observatory employing an EMI 6256 photomultiplier tube and pulse-counting electronics. As a compromise between photometric precision and the resolution of any rapid variation, 10 second integrations were used. The dates and times of observing hours are given in Table I.

Table I

Date	Times of observations(SAST)	Duration
25/26 October 1984	01.30 - 03.05	1 Hour 35 minutes
30/31 October 1984	21.05 - 23.40	2 Hours 35 minutes
01/02 November 1984	20.40 - 23.00 and 23.20 - 02.20	5 Hours 20 minutes
03/04 November 1984	20.35 - 23.25 and 23.40 - 02.15	5 Hours 25 minutes
21/22 November 1984	20.30 - 21.30 and 21.50 - 01.00	4 Hours 10 minutes
22/23 November 1984	20.30 - 21.30 and 21.50 - 01.00	4 Hours 10 minutes
	Total monitoring time:	23 Hours 15 minutes

The typical photometric precision of any 10 second integration was estimated by evaluating the statistical fluctuations of short periods of (sky subtracted) data selected at random from the observing runs; the mean of the standard deviations was found to be $0^m.015$.Flare activity of more than $0^m.090$ would thus be detectable at a high level of confidence (6σ) even if of short duration, quite adequate for UV Ceti-type flares which should typically produce a 'B' band flux increase if several tenths of a magnitude persisting for several hundred seconds.

No statistically significant flare activity greater than $0^m.09$ persisting for longer than 10 seconds was observed during the 23 hours of monitoring. Smaller amplitude flare activity cannot be completely discounted due to the photon noise statistics, but these are considered unlikely above $0^m.06$ (4σ) as any flares persisting for longer than 10 seconds should be detected at this lower threshold of activity. Flare activity below $0^m.06$ cannot be discounted by the observations.

In addition to monitoring, differential photometry was also obtained on the night of 01/02 November 1984 employing HD 6172 = SAO 225729 as the comparison star. No evidence of variability in excess of $0^m.03$ was detected, with the mean differential 'B' magnitude determined as $2^m.31$, within $0^m.01$ of the value determined by Arp (1958).

The complete absence of flares of the sort reported by Andrews et al. (1966) is disconcerting and suggests that Butler's Flare Star has quite long quiescent periods with very low levels of activity. An alternate possibility is that reported flare activity is erroneous, explaining the unusually early spectral type and the lack of emission lines in the spectrum.

In order to investigate these possibilities it is intended to resume photoelectric monitoring of Butler's Flare Star after an interval of a few months and if possible to obtain a contemporary spectral classification.

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POSSIBLE LIGHT VARIATION OF COMPARISON STAR FOR BY Dra : BD + 51°2410

The constancy of comparison stars is crucial in photoelectric photometry. In order to achieve acceptable level of transformation into the international systems it is necessary to choose comparison stars of about the same spectral types as those of the variables. In the case of red stars this causes a considerable problem since very many of the comparison stars are candidates for some kind of light variation.

The particular star that is dealt with here is C1 = BD+51°2410 = HD 172468 (K2) = SAO 31077. When observing BY Dra, most observers use two comparison stars, the second being C2 = BD + 51°2408 = HD 172268 (K5) = SAO 31070. Although no detailed investigation has been made to determine the constancy of these stars over a long time-scale, papers on BY Dra have already mentioned some problems with its comparisons.

The first to deal with the problem was Vogt (1981). Vogt compared his observations of C1 with those obtained in 1973 (Vogt, 1975) and found some discrepancy. He mentioned that "this disparity may well be due to real variations of one or both comparison stars."

In the same year Melkonian et al. (1981) reached the same conclusion. These authors found some variations in the observations made for C1 and C2 in the second half of 1975 (see Figure 1 in Melkonian et al., 1981) and mentioned that possibly C1 is responsible.

If we wish to know whether these small variations are real or not, so that we may avoid the problems which arise when we transform the data obtained in different places into the same system, we considered it necessary to have observations using the same telescope and equipment for a given series of observations.

Figure 1 a

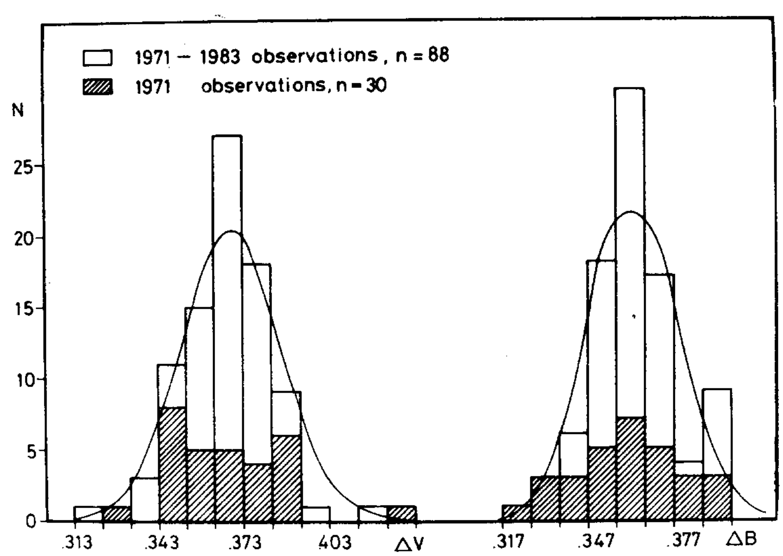
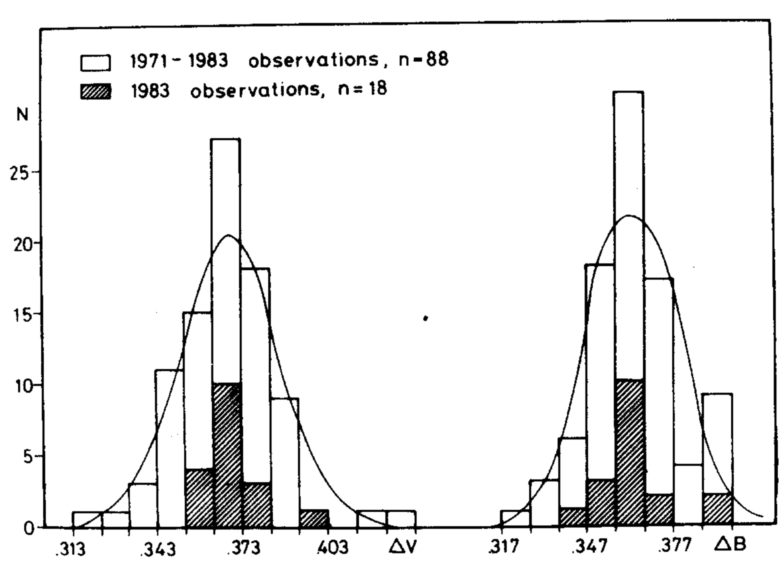


Figure 1 b

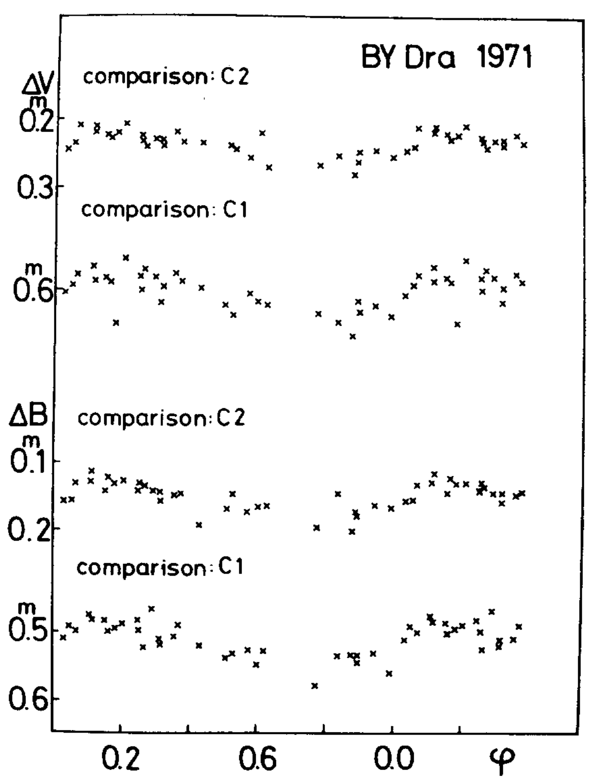


Our measurements for these stars made at Konkoly Observatory with the 60 cm telescope in 1971 and with the 50 cm telescope in 1983 give a possibility to investigate this problem.

In Figure 1 the distributions of the measured magnitudes (ΔV, ΔB)are displayed. The blank area represents all the observations made between 1971 and 1983, the hatched area shows the observations made in 1971 (upper panel) and in 1983 (lower panel). Although there were fewer observations in 1983 than in 1971 their distributions is much nearer to Gaussian one.

Chugainov (1973, 1974) made several observations for these stars. The histogram of all his observations again shows Gaussian dist ibution (with smaller standard deviation than ours), but the distribution of his 1971 observations is far from that.

Figure 2



The question is : Which of these comparison stars is variable ? When we plot the light curves for BY Dra itself with respect to C1 and C2 separately, it can be seen that the scatter is higher when using C1 as comparison star in the year 1971 (Figure 2) whereas in 1983 no difference between the light curves calculated with C1 and C2 can be found.

Since C1 is of the spectral type K2 (B-V=1.285, Vogt, 1975) it may show some kind of activity.

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THE OPTICAL BEHAVIOUR OF THE POLAR AM Her IN 1984

On the base of the sequence of comparison stars given by Hudec and Meinunger (1977) the star was measured on 160 blue-sensitive (ORWO-ZU21+GG13+BG12) and on 17 photovisual(ORWO-RP1+GG14) plates from 53 nights taken with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 1984 March 3 and 1984 November 29. In 37 nights more than one plate per night were obtained.

The long time light curve in B and V are shown in Figure 1. Like in the series of the years 1982 and 1983 two different states of the brightness behaviour of AM Her can be seen there. Concerning the active state, which is characterized by increased brightness caused by X-ray heating it is remarkable that the mean brightness amounts to $\bar{B} \approx 14^{m}_{\cdot}0 \pm 0^{m}_{\cdot}5$. This brightness behaviour which is similar to that of the series 1982 and 1983 is situated about 1.2 mag below the known maximum brigthness obtained from sky patrol plates and known from the long time light curve of former years given by Hudec and Meinunger (1977).

Numerous plates are obtained in the low state of the star. They permit to study the occultation light changes in that state.

A relationship given in Figure 2 was found between the measured B magnitudes and the derived colour indices B-V. The diagram, where increasing brightness goes with decreasing colour index contains also the data of the flare, which was observed in 1983 (Götz, 1984a) and in its lower part photometric observations published by Mazeh, Kieboom and Heise (1983).

The circles drawn in Figure 2 represent mean colour indices from more than one determination per night while colour indices (B-V) which were derived from nearly synchronous observations of our own series (B) and visual estimations given by Verdenet (1982-1984) are marked by crosses. But up to now the given relationship is still incomplete especially in the lower ranges of brightness.

In order to study the influences of occultation light changes to the overall light curve, all observations were reduced by means of the improved orbital elements.

Figure 1

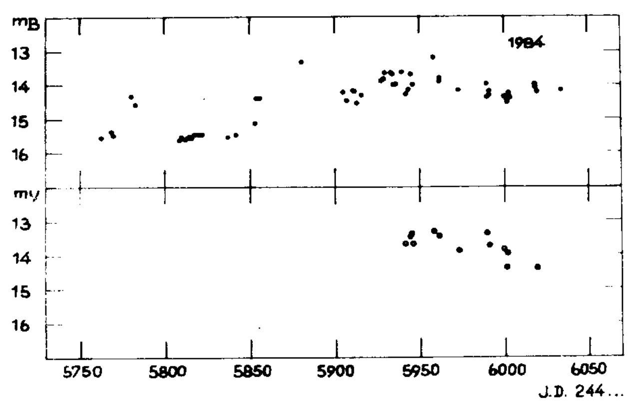


Figure 2

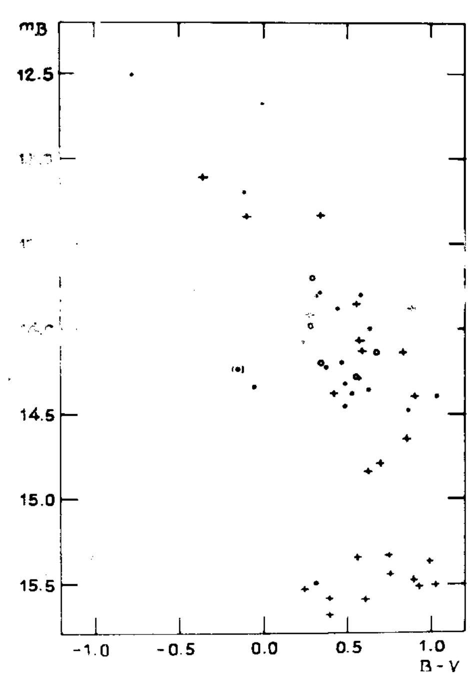


Figure 3

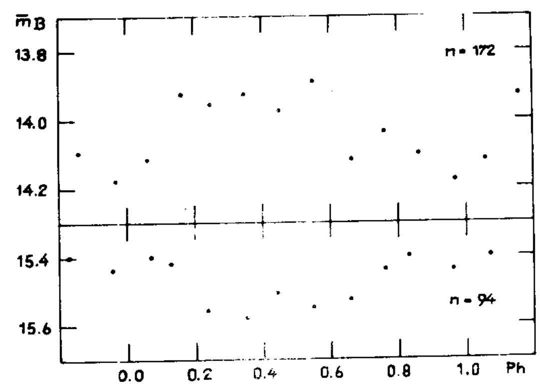
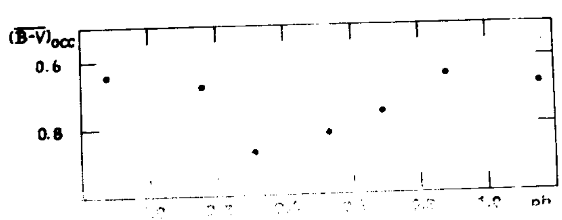


Figure 4



$$Min_{hel} = 244\ 5406.576 + 0^{d}.1289273? \cdot E \quad \text{(Götz, 1984b)}$$

to one common epoch.

The result is given in Figure 3, where the mean magnitudes $\bar{B}$ obtained separately from all observations of the high and the low states are plotted against the phases. The number of observations used from each state are drawn in. From Figure 3 it can be seen that in the low state the minimum phase is displaced to ph = 0.35.

The behaviour of the colour indices caused by the occultation light changes is shown in Figure 4. There, the mean colour indices $(\overline{B-V})_{occ}$ obtained reducing the observational data to $B = 14^{m}.5$ by means of the given colour magnitude relation are plotted against the phases. The result is nearly in agreement with that given by Priedhorsky and Krzeminski (1978). After that the largest colour indices can be expected at the phase ph≈0.30 while the lowest values are attributed to the minimum phase.

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PROBABLE DETECTION OF A VERY SHORT ORBITAL PERIOD FOR THE OLD CLASSICAL NOVA CP PUPPIS (1942).

Spectra of the old nova CP Pup were obtained from May 1 to May 5 1984 with the IDS detector of the ESO 1.5-m telescope of La Silla, Chile. Those of the first 4 nights in the range 4080-5290 Å had a dispersion of 59 Å/mm, while those of the last night in the range 4400-6750 Å had a dispersion of 114 Å/mm. Exposure times range from 20 to 40 min.

After reduction and various corrections the spectra showed signs of rapid changes on time scales of 1/2 hr. Because of this each of the exposures, corresponding to the two IDS apertures, used to construct our IDS image files, were considered separately.

Power spectrum analysis of radial velocities shows many peaks, because observations were grouped in runs of the order of 0.1 days for successive nights. However, as can be seen in Fig. 1, the HeII λ4686 emission line radial velocity peaks have themselves a "peak" between periods of 0.05 and 0.07 days, while H_β does not so clearly define a best period.

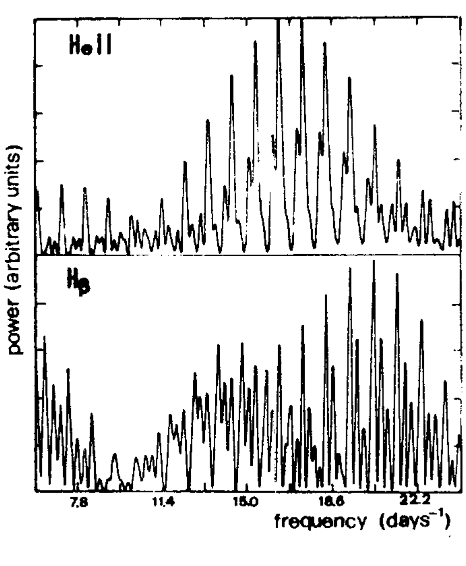

Fig.1. Power spectra of HeII λ4686 and H_β radial velocities. HeII solutions in the frequency range 14.3-19.3 days^{-1} are given in Table 1. Most of the peaks are separated by distances corresponding to integral multiples of the frequency for one day. Some periods are however more probable than others.

Table I

HeII λ4686 radial velocity solutions between P = 0.05 and P = 0.07 days

P (days)	Comments
0.06977	H_β radial velocity better than following, but HeII worse
0.06518	H_β radial velocities very bad
0.06115	quite good; also given by χ^2 method for HeII equivalent widths
0.05765	not so bad
0.05169	worse for both H_β and HeII radial velocities

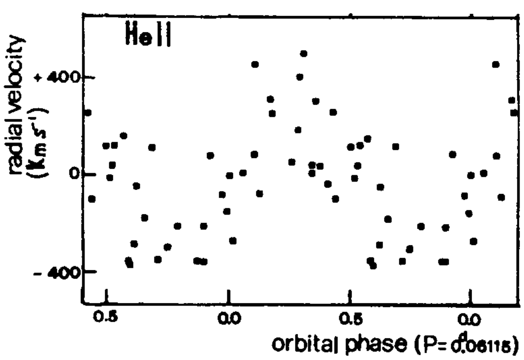

Fig.2. Radial velocity curve of HeII λ4686(single aperture spectra)emission line. Orbital phases are given for P=0.06115 days, To=JD2445822.5217.

Various arguments including the scatter of the points, and the phase of what appears to be an eclipse of H_β suggest a most probable period of 0.06115 days (see Fig. 2). The equivalent widths of HeII λ4686 also appear to have the same period.

This is the first orbital period of an old classical nova which would appear to be below the cataclysmic binary period gap (Robinson, E.L.,1983 IAU Colloquium No.72,Dordrecht:Reidel,101,1). New observations are needed to settle the question as to whether the true binary period was detected, rather than the orbital period of a blob in the disc or some kind of pulsation.

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PHOTOELECTRIC OBSERVATIONS OF V375 Cas

The eclipsing binary V375 Cas, BD+62°2332, was observed photoelectrically with the 60 cm telescope at Beijing Astronomical Observatory in August-November 1982.

A total of 604 photoelectric BV observations were obtained on 8 nights. The coordinates of the comparison star and check star are given in Table I.

Table I

Name	BD No.	R.A. (1982)	Dec. (1982)
Comp.Star	+62°2333	$23^h 56^m 23^s$	63°00'49"
Check Star	+62°2331	23 56 00	63 06 31

All the observations were corrected for differential extinction and transferred to UBV system. The times of minimum light determined with the Kwee and Van Woerden's method are given in Table II.

Table II

JD Hel. 2445000+	filter	m.e.	rem.
210.0803	B	0.0006	II
.0824	V	0.0020	II
235.1235	V	0.0005	II
.1249	B	0.0006	II
265.3291	V	0.0011	I
.3314	B	0.0004	I
266.0680	V	0.0014	II
.0683	B	0.0011	II
294.0618	V	0.0014	II
.0631	B	0.0016	II
296.2715	B	0.0009	I
.2743	V	0.0006	I
635.1497	V	0.0006	I

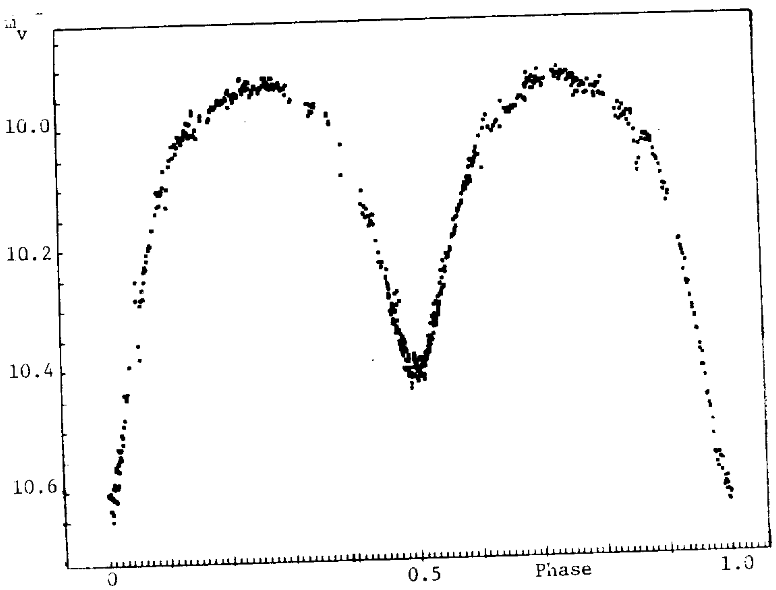

Figure 1 a

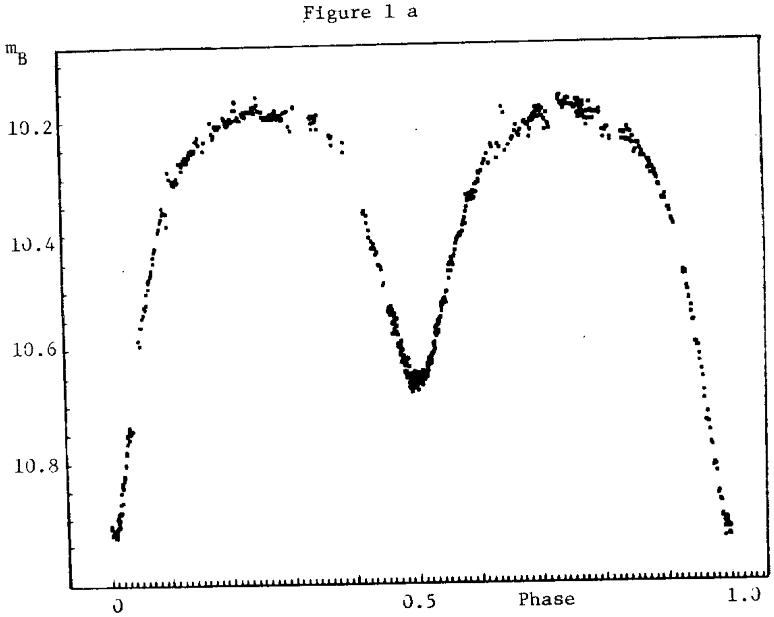

Figure 1 b
BV light curves of V375 Cas in 1982.

Using the above new photoelectric minima together with the photographic minima given by Chuprina (1959), Grigoriskii (1959), Satanova (1960) and Kukarkin and Novikov (1960), the new ephemeris has been derived by the weighted least squares as follows

$$\text{JD Hel. Min I} = 2445635.1514 + 1^{d}.47338191 \cdot E$$
$$\pm .0016 \quad \pm .00000028$$

The B, V light curves are given in Figure 1.

The light curve of V375 Cas is similar to that of AW ac (Jiang et al., 1983). A complete analysis of the light curves of V375 Cas will be presented elsewhere.

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Corrigenda

IBVS No.	Page	Line	incorrect	correct
2274	2	3	2444985.908	2444985.1908
2275	1	7	four times	three times
2275	1	8	four times	three times

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PHOTOELECTRIC OBSERVATIONS OF V541 Cas AND ITS PERIOD

The eclipsing system V541 Cas was observed photoelectrically from September to December in 1982 with the 60 cm reflector at Beijing Astronomical Observatory. Some minimum times were obtained in December 1983 and September 1984.

The photoelectric equipment is very close to the Johnson's standard system. A total of 470 photoelectric BV observations were corrected for differential extinction and transferred to UBV system.

The coordinates of the comparison and check stars are given in Table I.

Table I

Name	R.A.(1982)	Dec.(1982)
Comp.Star	$2^h33^m05^s$	63°10'20"
Check Star	2 32 44	63 10 02

Using Kwee and Van Woerden's method, seven times of primary minimum and five times of secondary minimum were determined. They are given in Table II.

Table II

JD Hel. 2445000+	filter	m.e.	Min.	JD Hel. 2445000+	filter	m.e.	Min.
231.2429	V	0.0006	II	231.2425	B	0.0008	II
232.1523	V	0.0006	II	232.1527	B	0.0001	II
236.2487	V	0.0007	I	236.2472	B	0.0004	I
258.0832	V	0.0009	I	258.0834	B	0.0003	I
266.2743	V	0.0007	I	266.2732	B	0.0006	I
267.1832	V	0.0011	I	267.1809	B	0.0010	I
293.1125	V	0.0006	II	293.1120	B	0.0002	II
298.1162	V	0.0020	I	298.1151	B	0.0008	I
329.0510	V	0.0005	I	329.0517	B	0.0007	I
675.2475	V	0.0001	II	675.2473	B	0.0001	II
962.3050	V	0.0004	I				
967.3099	V	0.0006	II				

V541 Cas is a rather neglected system. In 1974 Busch gave its ephemeris as follows:

$$\text{JD Hel. Min I} = 2439026.542 + 0^d.909026 \cdot E$$

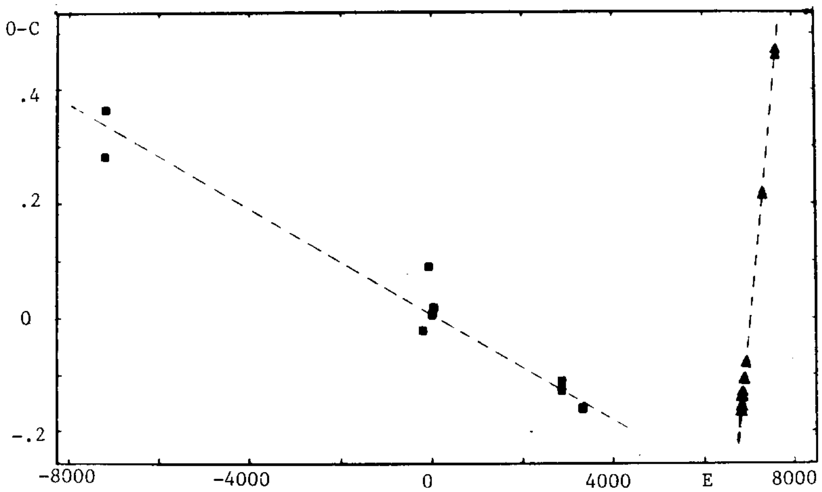

Figure 1 : O-C Diagram of the times of minimum light of V541 Cas. "▲" represents photoelectric observations.

Table III

JD Hel.Min.	E	(O-C)	Min.	Method	Observer
2432477.4000	-7204.5	0.2829 d	II	pg.	Weber (see Busch,1974)
503.3900	-7176.0	0.3643	I	pg.	Weber (see Busch,1974)
8843.3300	- 201.5	-0.0219	II	pg.	Romano (see Busch,1974)
950.2600	- 84.0	0.0921	I	pg.	Romano (see Busch,1974)
9026.5370	0.0	0.0070	I	pg.	Busch
27.4510	1.0	0.0119	I	pg.	"
53.3640	29.5	0.0164	II	pg.	"
57.4570	34.0	0.0185	I	pg.	"
58.3540	35.0	0.0065	I	pg.	"
88.3640	68.0	0.0171	I	pg.	"
41595.4580	2826.0	-0.1109	I	pg.	"
96.3540	2827.0	-0.1240	I	pg.	"
602.2740	2833.5	-0.1130	II	pg.	"
42036.3120	3311.0	-0.1571	I	pg.	"
45231.2427	6825.5	-0.1617	II	pe.	this paper
32.1525	6826.5	-0.1610	II	pe.	"
36.2480	6831.0	-0.1563	I	pe.	"
58.0833	6855.0	-0.1387	I	pe.	"
66.2738	6864.0	-0.1299	I	pe.	"
67.1821	6865.0	-0.1307	I	pe.	"
93.1122	6893.5	-0.1091	II	pe.	"
98.1156	6899.0	-0.1056	I	pe.	"
329.0514	6933.0	-0.0783	I	pe.	"
675.2474	7313.5	0.2156	II	pe.	"
962.3050	7629.0	0.4608	I	pe.	"
967.3099	7634.5	0.4658	II	pe.	"

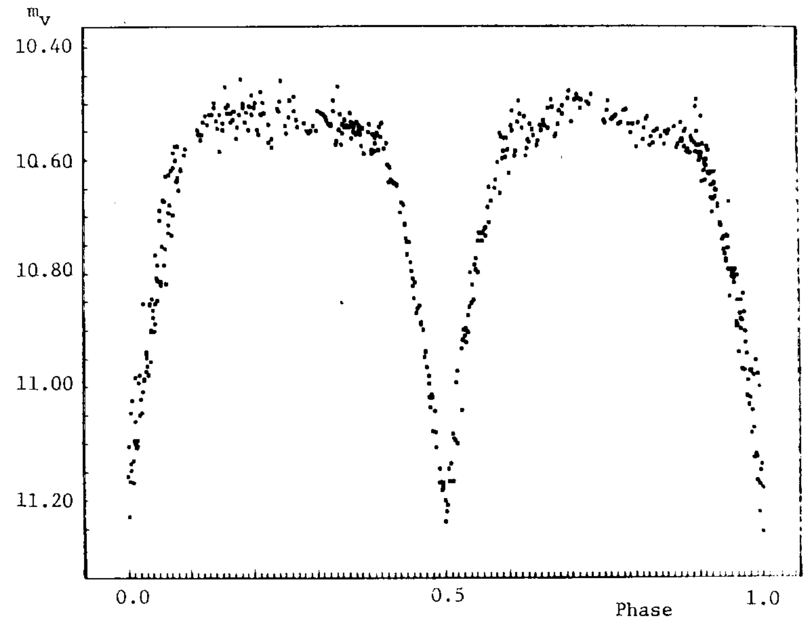

Figure 2 a

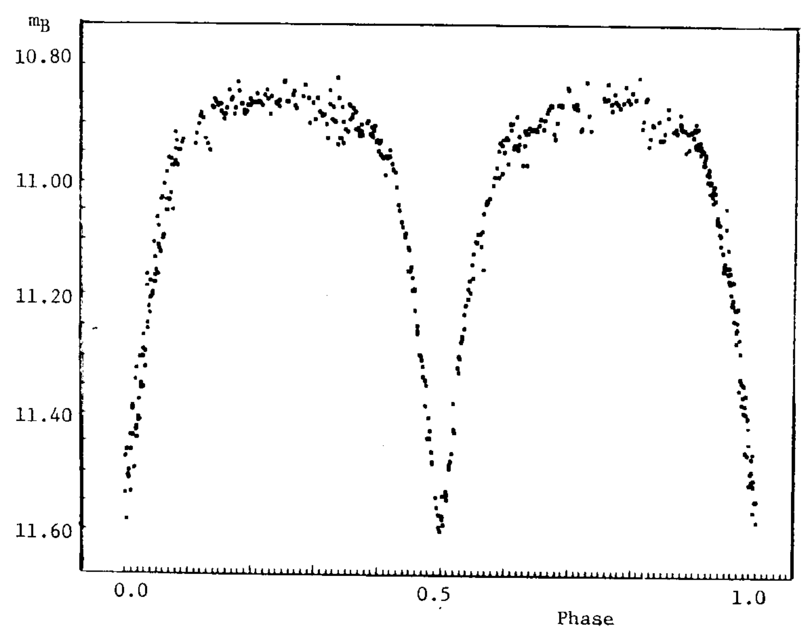

Figure 2 b

Figure 2 BV light curves of V541 Cas in 1982.

This ephemeris, however, cannot be extended till the recent times of minima (in Table II), and the period 0.909026 days also cannot be used to combine our BV observations into smooth light curves.

Table III listed all the historic minima and their O-C based on ephemeris (1). The O-C diagram (see Fig. 1) reveals that an abrupt change in the period of V541 Cas happened between 1973-1982.

If we simply use our much more accurate photoelectric minima, the following new light elements could be proposed for current use after 1982

$$\text{JD Hel. Min I} = 2445962.3049 + 0^{d}\!.90984695 \cdot E$$
$$\pm .0003 \pm .00000044 \cdot E$$

The B, V light curves of V541 Cas are shown in Figure 2.

It shows that: (1), there are obvious brightness variations outside the eclipse; (2), the primary and secondary minima have almost the same depth; (3), its light curve is very similar to those of detached system AT and AZ Cam (Zhai et al, 1983 and Zhang et al., 1984).

The light curve of the star and the change of its period should be analyzed in more detail in a subsequent paper.

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Zhang Rong-xian, Zhang Ji-tong and Zhai Di-sheng, 1984, Acta Astronomica Sinica, 25, 42

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THE DWARF NOVA SVS 2549, A SHORTPERIODIC ECLIPSING SYSTEM

The Soviet Variable Star (SVS) No.2549*) was discovered by Lipovetskij and Stepanyan (1981); in the quoted paper this is the star No.4. The star has an OB-spectrum with Balmer emissions in minimum light. The outburst of the star is seen in the Palomar Sky Survey charts. The position of the star with 1 " accuracy determined by us using two plates of the 40 cm astrograph is the following: $23^h20^m39^s.47$ + $18^\circ08'42''.0$, 1950.0. The chart of the variable star and comparison stars for photoelectric observations is given in Figure 1. The magnitudes and colour indices given below were measured with the UBVR photometer at the 6 meter reflector of the Special Observatory of the Soviet Academy of Sciences, the prime focus cage observer was S.I. Neizvestny.

	V	B−V	U−B	V−R
A	13.62	+0.53	+0.10	+0.45
B	13.80	+1.02	+1.04	-

The star was studied by a group of amateur variable star observers using the Moscow plate collection. 90 plates obtained at the Crimea 40 cm astrograph of the Sternberg Institute in the time interval JD 2444076-45695 (1979-83) were employed to estimate the star brightness. Six large outbursts of the star were detected by photographic data thus confirming its SS Cyg type. The outbursts are the following.

JD 24...	B	JD 24...	B
44085	12.0	45531 }	12.8
44199	12.6	45536 }	13.0
45258	13.0	45619	12.3
45337	13.9		

The interval between outbursts varies in the range from 79 to 114 days, the mean value is 95 days.

Strong light variability of minimum light amounting 2 magnitudes is detected. This variability turns out to be caused by orbital motion in a close binary system, and it is connected with the periodically repeating hump in the light

*) New GCVS designation is IP Pegasi.

curve the mean amplitude of which is 1^m, but sometimes raises to $1\overset{m}{.}5$. The photographic light curve shown in Figure 2 is plotted versus phases of the light elements we have determined:

$$\text{Hump Max}_{\odot} = 2445615.394 + 0\overset{d}{.}15820764 \cdot E$$
$$\pm 30$$

The mean light level changed abruptly sometime during JD 2444526-44820. Earlier observations are shown in Figure 2 by circles.

A dip in the light curve near the phase $0\overset{p}{.}19$ may be suspected to be an eclipse, the duration of which is less than the exposure time 45 minutes.

The star was observed at the 6 m reflector in the UBV system on 1984 July 27/28 during a high state with increased brightness. These observations confirmed the 95^d cycle, because exactly three cycles passed since the latest photographically observed outburst on JD 2445619. The observations were carried out since 23^h13^m till 0^h14^mUT. The brightness of the star dropped gradually during this time from 14.02 to 14.20 V, B-V = +0.34, U-B = -0.90, V-R = +0.87 (Figure 3). No hump was observed in the light curve. On JD 2445909.519 the brightness fell suddenly by 2^m in two minutes. Having not expected such behaviour of the star, we measured the comparison star to control sky and device conditions, and the eclipse minimum was missed. The ascending branch lasted 18 minutes. The star became redder during the light minimum and reached B-V=+0.8.

The photoelectric monitoring of the star in minimum brightness was carried out in August 1984 with the 1 meter reflector of the Tadjik Academy of Sciences Institute of Astrophysics on Mount Sanglock. The two sets of observations were obtained, the first one on August 20 since [illegible]$^h37^m56^s$ till $22^h19^m35^s$ UT and the second one on August 31 since [illegible] till [illegible] UT. The observations are plotted in Figure 4 versus the orbital phase.

The data show that out of eclipse the brightness varies from 15.0 to 16.0 B, no flickering is seen. The eclipse is total and strongly asymmetric. The partial eclipse duration is D = 42^m = $0\overset{p}{.}183$, that of the total eclipse is d = $5\overset{m}{.}5$= $0\overset{p}{.}024$, the totality brightness is 18.6B. The descending branch lasts for 14 minutes, the ascending one 22.5 minutes. The light increase and decrease are nonuniform, the steps and delays are seen. Twice a jump brightening by $0\overset{m}{.}15$ was observed before the first contact. Two moments of mid-totality are determined; JD 2445933.4094 and 45944.4833. The later one is less reliable because of the dawn.

The light curves in low (solid curve) and high states are compared in Figure 3.

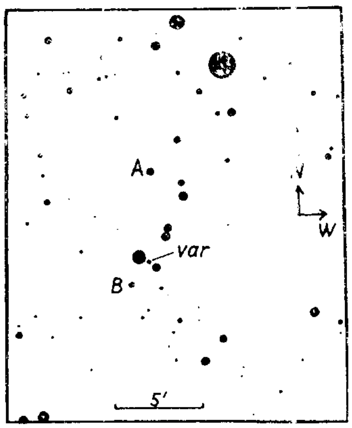

Figure 1: The identification chart of SVS 2549. The photo-electric standard stars are indicated.

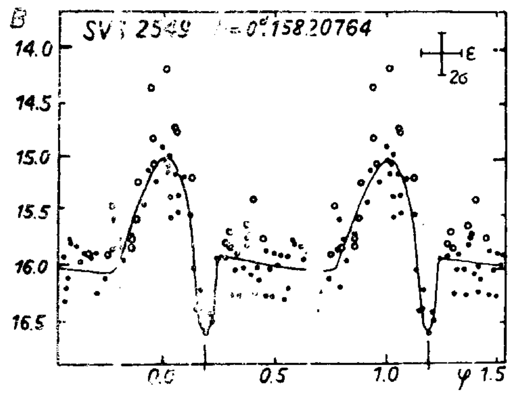

Figure 2: The photographic light curve of SVS 2549. The segments of cross are the accuracy of light estimates and the exposure duration in the scale of phase.

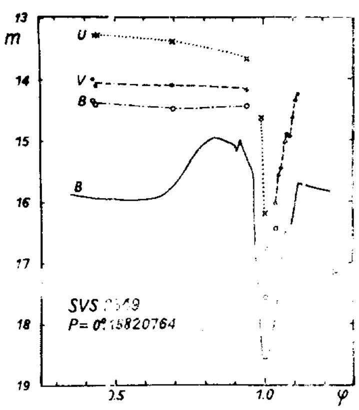

Figure 3: UBV observations of SVS 2549 at the 6 m telescope. The solid line is the light curve in the low state plotted for comparison. Zero phase is at JD 2445933.4094.

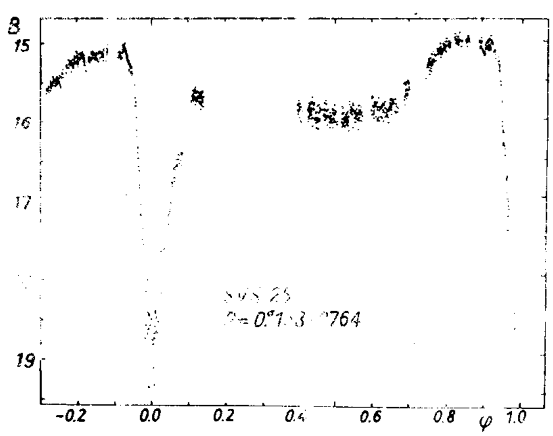

Figure 4: Photoelectric monitoring light curve obtained at the Mount Sanglock Observatory on 1984 August 20 and 31 and plotted versus orbital phase. Zero phase is at JD 2445933.4094.

The phase of sharp light decrease observed at the 6 m telescope coincides with that of mid-totality in the low state.

Our observations suggest that SVS 2549 is a dwarf eclipsing system with low luminosity components and edge-on accretion disc. That is why the fraction of the hot spot in the common light caused by interaction of gas stream and disc is very large. The deep eclipses during outburst in SVS 2549 resemble those in HT Cas. The system is useful to solve the problem of the nature of SS Cyg type star outbursts and should be studied in details.

Interesting results may be obtained by visual monitoring of outbursts by amateur astronomers. If the outburst cycle will stay stable, the star may flare up in the end of October 1984 and the end of January - the beginning of February 1985.

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Reference :

Lipovetskiy,V.A., Stepanyan,J.A., 1981, Astrofizika 17, No. 3, 573.

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PHOTOMETRY OF HD 23838

The star HD 23838 (≡ HR 1176) is included in the list of F, G & K stars having Ca H and K emission compiled by Eggen (1978). It is also included in the catalogue of emission line stars compiled by Bidelman (1954). It is thought to be a dwarf star of spectral type G0. Young (1939) has given a range of 40 km s^{-1} for its radial velocity while Abt (1969) found a range of 24 km s^{-1}. This made us suspect that HD 23838 could be an RS CVn type binary. To verify this, we have monitored this system photoelectrically as a part of our long term photometric program on RS CVn and related binaries.

We observed this system on 10 nights during 1980-81 and 1981-82 observing seasons using the 1.22m reflecting telescope of the Japal-Rangapur Observatory. HD 23728 and HD 23477 were used as comparison and check stars, respectively. The photometric equipment, method of observation and the reduction techniques employed for deriving Δm(var-comp) have been described in a previous paper on UV Piscium (Vivekananda Rao and Sarma 1983). The r.m.s. of Δm(check-comp) was found to be $\sim 0^{m}.02$ which indicates that the comparison is constant in brightness during the period of our observations. The values of Δm(var-comp) along with the times of observations (HJD) are available with us. As no orbital period for this system is available in the literature, we have plotted in Figure 1 the observed Δm(var-comp) versus HJD in UBV passbands.

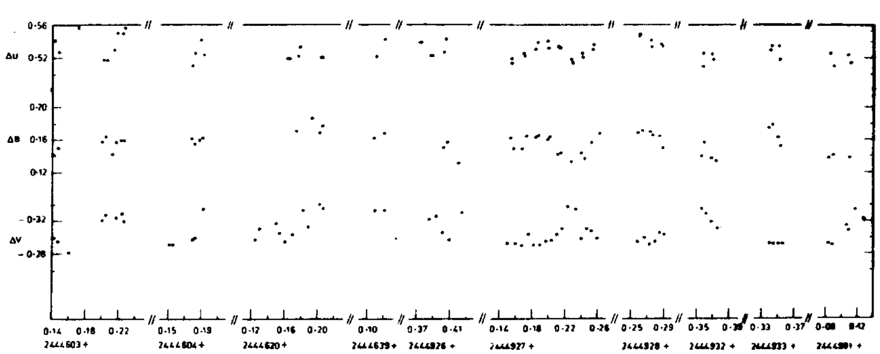

Figure 1: Photometric observations of HD 23838 in UBV passbands.

From these figures it is evident that during each of the nights the system HD 23838 does not show any systematic or abrupt variability except for small scatter which is comparable to that of the Δm(check-comparison) values. It is also found that on all the nights the mean magnitudes of the system in each of the UBV passbands remained constant within the observational uncertainties.

Spectroscopic observations of HD 23838 were made by Raghavendra Rao (1983) during the 1981-82 and 1982-83 observing seasons on 13 nights. No detectable Ca II H, K emission feature was found on any of these nights. This is quite surprising in view of its classification as Ca II emission line star both by Bidelman (1954) and Eggen (1978). It is conceivable that the star may be in low activity phase of its stellar activity cycle during our observation period. Further spectroscopic observations are required to check this suggestion.

Hence based on the presently available photometric and spectroscopic information it appears very unlikely that HD 23838 belongs to the RS CVn group.

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THE LIGHT CHANGES OF RT LACERTAE

The eclipsing system RT Lac is known as an active binary among the RS CVn type stars. The behaviour of the system is very interesting both in optical and radio regions. The existence of sinusoidal distortion on its light curves has been subject to various investigations (cf.Ibanoğlu et al. 1980, Milone 1976, 1977, Tunca et al. 1983). Examining all available light curves obtained between 1890 and 1970, Hall and Haslag (1976) estimated a period of about 9.5 years for the migration of the wave. They have also derived a star spot cycle of about 30 years from the variations of the amplitude of the wave.

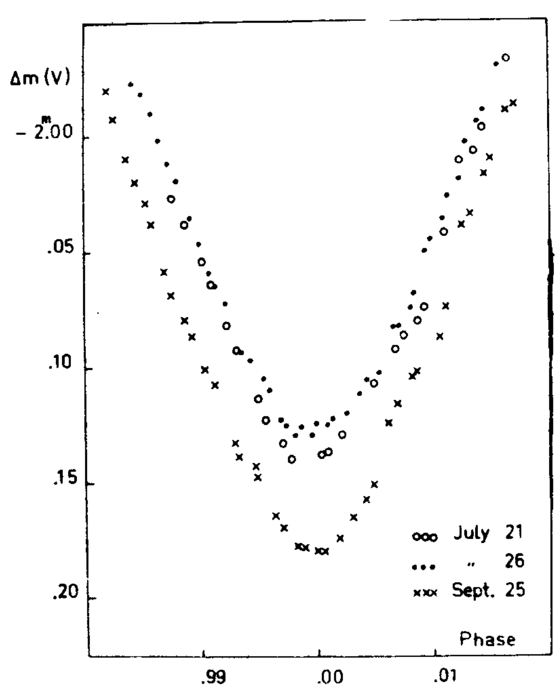

Figure 1 : The primary eclipses obtained in July and September 1984.

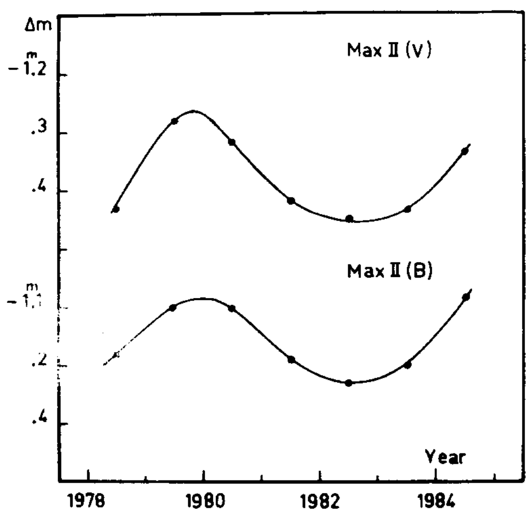

Figure 2 : The variations of the mean brightness of the system at second quarter in yellow and blue light.

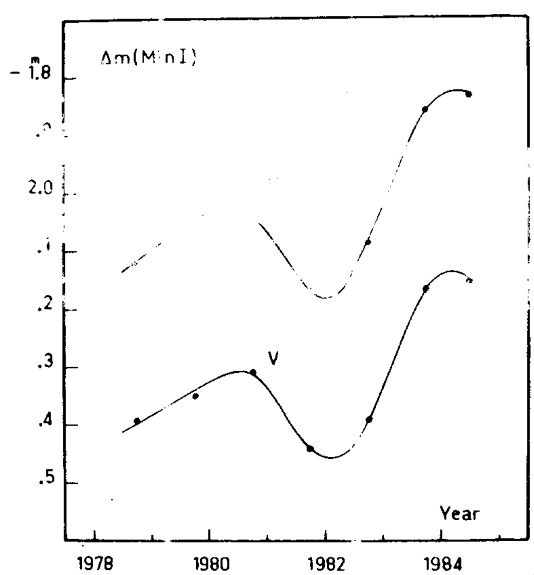

Figure 3 : The variations of the mean brightness at mid-primary in blue and yellow light.

Recently, Evren et al.(1984) published their results obtained from the photometry during last six years. The light variations during primary eclipse and also at second quarter show a similarity according to their investigation. But the period found from light variations at primary eclipse is shorter than that of second quarter. The mean period of about 4.5 years for the light variation has been suggested.

The system has been observed again in 1984 observing season. The observations during primary eclipse obtained on July 21, 26 and on September 25 have been plotted versus orbital phase and are shown in Figure 1. It is clearly seen that the brightness of the system has been changed within each orbital revolution. The observations obtained at the end of September show that the depth of the primary eclipse has been started to increase again. The mean brightnesses at second quarter and at primary eclipse have been also plotted in Figure 2 and 3. Figure 3 shows that the brightness of the star seen at the primary eclipse has been starting to decrease. We estimate that it will reach its minimum brightness about 1986 observing season.

Results of an international observing program at different wavelengths, which will be carried out in the next two years, of this peculiar system will of course yield us valuable information about RT Lac.

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TWO-COLOUR PHOTOELECTRIC LIGHT CURVES
OF THE ECLIPSING BINARY V367 Cyg

The light-variability of V367 Cyg, which was first suspected by Humason, was confirmed by Christie (1932). Here I present the latest light curves of the system.

The eclipsing binary V367 Cyg was observed in B and V colours at the Ege University Observatory from August 22 to December 9, 1984. The observations were made with the 48 cm cassegrain telescope equipped with an unrefrigerated EMI 9781A photomultiplier. BD + $38^{o}4239$ was used as comparison star. A total of 250 observations in each colour were obtained on 23 nights. The phases of the observations have been computed from the ephemeris given by Abt (1954):

$$\text{Primary minimum} = \text{JD } 2434\ 266.296 + 18^{d}.5972\ E.$$

The differential observations in the sense comparison minus variable were corrected for atmospheric extinction and the times of individual observations were reduced to the Sun's centre. Figure 1 and Figure 2 show the B and V light curves of V367 Cyg, respectively.

It can be seen from Figure 1 and Figure 2 :

a) that the maxima preceding primary minima are brighter than the maxima following primary minima (this feature is well distinguished especially in the B light curve rather than the V light curve)

b) that the ascending branches of the light curves are slightly steeper than the descending branches,particularly in the secondary minima.

These two characteristics of the present light curves of the system are in well conformity with those of Christie, Kukarkin and Parenago, Filin, Gaposchkin, and of Heiser (see Heiser, 1962).

Normalizing these new light curves to 0.0 mag at phase 0.75 a further approximate comparison with the earlier ones can be made. Doing so, it can be easily seen that both the primary and the secondary minima fall between those

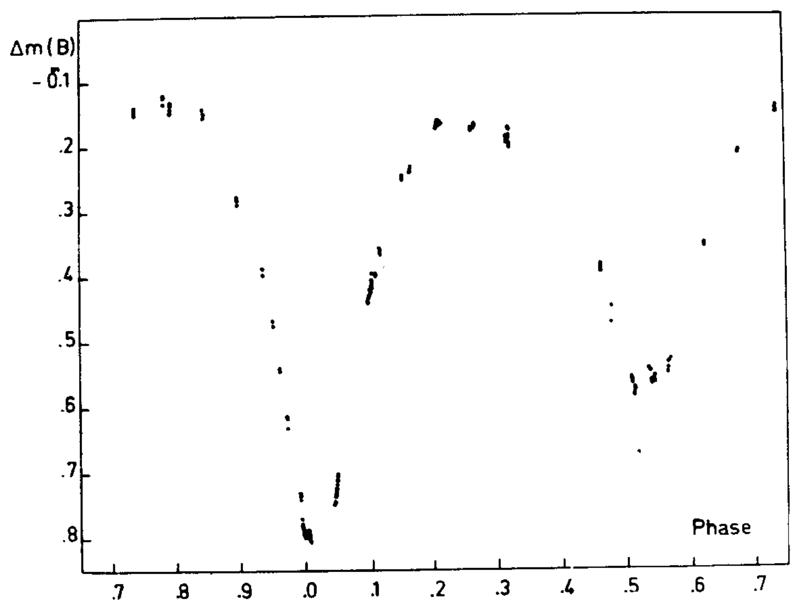

Figure 1 : The B light curve of V367 Cyg in 1984.

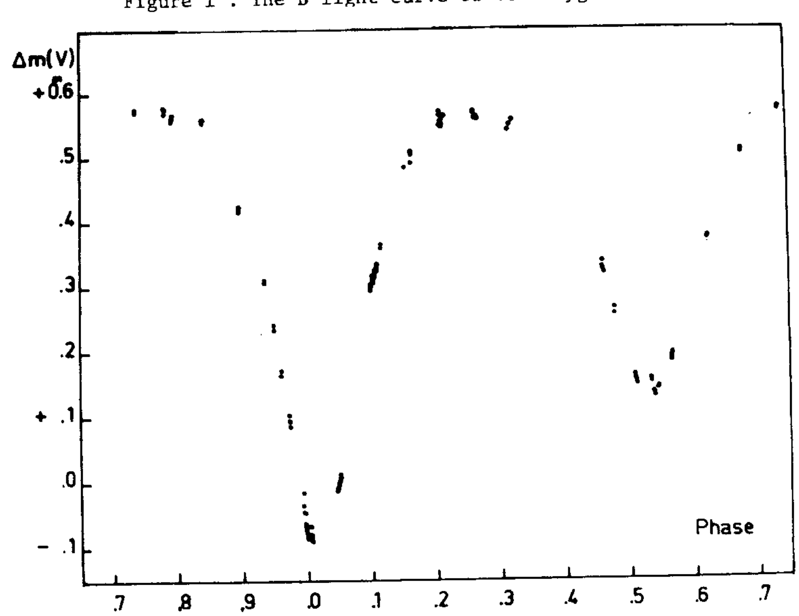

Figure 2 : The V light curve of V367 Cyg in 1984.

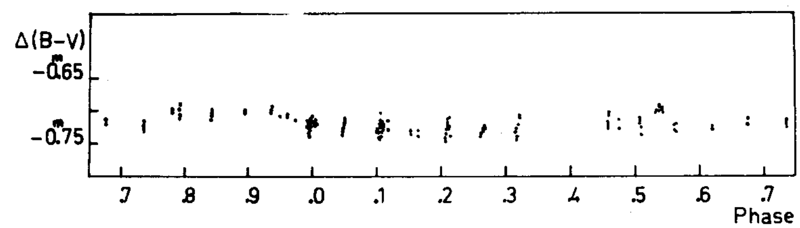

Figure 3 : The (B-V) curve of V367 Cyg in 1984.

of Filin and of Gaposchkin (see Heiser, 1962). This, once again proves the fact that the depths of the minima of V367 Cyg varies with time.

The colours of V367 Cyg as a function of phase, shown in Figure 3, have some slight variations of small amplitude. Considering the sudden reddening between phases 0.95 and 0.00, and the abrupt variation towards blue near the phase 0.54 which is coincident with the secondary minimum of the light curve, it is possible to say that the primary star is the hotter star.

It should be noted here that computation of a new time of primary minimum was especially avoided since the quantity of the observations at the mid-primary had been considered insufficient to permit such an attempt. The photoelectric observations of V367 Cyg will be continued in the coming observing season.

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SOME NEW SPECTRAL CLASSIFICATIONS FOR NAMED AND SUSPECTED VARIABLE STARS

The variables listed below were routinely picked up for being spectral type M6 or later, or for showing probable Hα emission, in a recently completed objective prism survey. This survey covered completely the sky north of declination -25° and further than 10° from the galactic plane, employing the visual-red spectral region. The classifications cited here were done from the 6100-6800 A wavelength region, dispersion 1000 A/mm at Hα. None of these stars has a published spectral type that I am aware of.

NAMED VARIABLES

CM And	M8	AM Hya	M7
FH And	M7-8	AQ Hya	M7
DH Aqr	M6-7	SV Leo	M7
EP Aql	M5e	UV Lib	M6,e?
GX Aql	M7	CV Lib	M6
V502 Aql	M6[S:]	DX Lib	M7e
SW Cap	M7-8	EK Lib	M7e
BB Cyg	M7-8	SX Lyr	M8
UX Del	M7	AR Lyr	M7
WX Del	M7	AS Lyr	M7
AF Del	M7+	CV Lyr	M6+
XX Dra	M7	DL Lyr	≥M7
AM Dra	M8	IV Lyr	M7
AY Dra*	M7:	OP Lyr	≥M7
RR Equ	M6-7	CW Oph	M7:
SW Eri	M9	V397 Oph	M7
AF Eri	M7:	V836 Oph	M7
AV Eri	M6-7	V2070 Oph	M6-7
IU Gem	M7	V2098 Oph	M6:
WX Her	M1e	FW Ori	M7
AV Her	M6-7	TZ Psc	M8
BU Her	M6-7	XY Peg	M7
DN Her	M6-7	PZ Per	M8
EN Her	M6	DZ Sgr	M6
ET Her	M6	EP Sgr	M6+

*My measured position is $15^h36^m20^s.3$, $+57°20'56''$ (1900.0). The position in the 3d edition of the GCVS differs from this by several minutes of arc.

NAMED VARIABLES, CONTINUED

FX Her	M7	FG Sgr	M6:
KN Her	M7	FS Sgr	M7:
KS Her	M7	V360 Sgr	M7
KT Her	M6	V2119 Sgr	M6-7
KQ Her	M8	V2127 Sgr	M6+
LY Her	M7	UV Sco	≥M6
MV Her	M6-7	KU Sco	M6
V393 Her	M8	V770 Sco	≥M6
V400 Her	≥M6	V779 Sco	M6-7
V455 Her	M6+	V814 Sco	M6
V456 Her	M7	VW Ser	M7
V460 Her	≥M6	WY Ser	M7-8
AX Ser	M7	SY Vir	≥M6
BZ Tau	M6-7		

The second table lists spectral classifications from the aforementioned survey plates for stars having no spectral types given in the new catalog of suspected variable stars (NSV), nor a published type anywhere else, to my knowledge. The identification numbers are the NSV numbers.

SUSPECTED VARIABLES

3992	≥M6	7369	≥M6
3994	≥M6	8001	M7
4422	M7	8100	M6:
5572	M6	8186	M7
5749	M7,e:	8224	M7:
7125	M6:	9520	M7
7152	M6	9827	M6-7
7368	M6	14411	M7:

I am indebted to W.P. Bidelman for the use of his data file.

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RECENT DATA ON 22 VULPECULAE

Parsons and Ake (1984) recently appealed for observations o. .? Vul to be made during .ts eclipse in August 1984. The star is a ζ Aur-like system, containing a G3 supergiant with a B9 companion in a 249^d orbit.

We present here photoelectric photometry and radial velocity measurements made by us at the David Dunlap Observatory during this time.

The photometry is on the standard Stromgren four-colour system and also includes measures of the β-index and (V-R) and (V-I) on the Kron-Cousins system. It was obtained with a twin-photometer two-telescope photon-counting system involving our 0.5 m and 0.6 m telescopes, in which one telescope observes the variable while the other observes the comparison star. Each photometer is itself a two-channel device with a chopper that removes the sky background signal at the relatively high speed of 60 Hz. The system is automated under computer control to ensure exact simultaneity of the observations. The relative sensitivities of the two units is monitored frequently by setting both telescopes on the same star, but drift has been found negligible at the level of two or three thousandths of a magnitude over a night.

We used the comparison star, HD 192712, recommended by Parsons and Ake. Absolute photometry of this star on four good nights was consistent and yielded the values shown in Table I. The standard errors listed are internal, based on the fourteen observations per filter made on the four nights. All our results for 22 Vul are derived from differential measures referred to the values of HD 192712 given in Table I. Note, however, that our V magnitude of 7.184 for HD 192712 is somewhat fainter than 7.15 quoted by Parsons and Ake.

TABLE I
Photometry of HD 192712

V	= 7.184 ±	0.004	β	= 2.608 ±	0.007
b-y	= 0.574	0.005	(V-R)KC	= 0.546	0.002
m1	= 0.423	0.005	(V-I)KC	= 0.944	0.004
c1	= 0.380	0.010			

The data for 22 Vul are listed in Table II. Each number is the average of four or five observations made per night, with a typical internal standard error of 0.004 mag, except for the c1 measures. Here, owing to the involvement of the u-filter, red stars, and old mirror-coatings, the standard errors average 0.025 mag.

Plots of our data show that they do encompass the shallow eclipse of the star, but since Parsons is to collate data from all observers for discussion, any discussion here would be premature.

TABLE II
Photometry of 22 Vul

HJD	V	b-y	m1	c1	β	(V-R)KC	(V-I)KC
2445929.677	5.167	0.623	0.397	0.320	2.662	0.527	1.010
30.677	5.199	0.610	0.437	0.316	2.641	0.544	1.010
32.649	5.202	0.611	0.432	0.302	2.655	0.539	1.013
34.652	5.191	0.613	0.410	0.356	2.659	0.523	1.003
37.668	5.233	0.659	0.505	0.293	2.643	0.546	1.028
39.667	5.226	0.662	0.519	0.493	2.648	0.546	1.030
43.662	5.236	0.671	0.484	0.400	2.644	0.547	1.021
48.603	5.194	0.633	0.387	0.360	2.673	0.534	1.027
50.625	5.173	0.630	0.400	0.421	2.738	0.538	1.011
61.588	5.180	0.626	0.413	0.336	2.655	0.530	0.988
64.612	5.183	0.626	0.410	0.266	2.657	0.525	0.991

We also obtained five spectrograms of 22 Vul on vacuum sensitized IIaO plates with the cassegrain spectrograph attached to our 1.9 m telescope. The first spectrogram was obtained by Dr Nancy Evans in June 1981 and covered the spectral region 3500 to 4950 A at 12 A/mm. The other four were taken in September 1984, covering 3500 to 4600 A at 8 A/mm. Projected slit width was 22 microns, and the spectra were widened to either 0.5 or 0.8 mm.

All the spectra were digitized with the Observatory's PDS microdensitometer. The radial velocity of the primary was determined from the digitized spectra using a computer program which determines the positions of selected absorption

TABLE III
Radial Velocities of 22 Vul

HJD	Rad. Vel. km/sec	s.e. km/sec	Comment
2444782.816	+1.1	0.4	
5961.622	-6.9	0.3	
5962.600	-6.5	0.4	Some flexure
5963.635	-6.6	0.4	
5964.667	-5.2	0.4	

lines using least-squares parabolic fits to the line cores. Typically 30 to 35 lines were used. Table III contains the results. Weak CaII H and K emission, probably associated with the G3 supergiant, can be seen on all the spectra. Again, any discussion here would be premature.

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Reference:

Parsons, S.B., and Ake, T.B. 1984, AAVSO Photoelectr.Phot.Newsltr, vol.5, No.1, p6.

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RAPID SPECTROSCOPIC AND PHOTOMETRIC VARIATIONS IN o Cas

o Cas (HD 4180, HR 193, BD + $47^{\circ}183$, SAO 36620, MWC 8) is a bright Be star (m_V=4.5, B5IIIe).

The photometric variability of o Cas was first reported by Haupt and Schroll (1974). The comparison of their own measurements and values given by other authors (apparently absolute photometry) revealed 0.15 mag in V, while the variations in both B-V and U-B were negligible.

The infrared photometry and spectroscopy of o Cas was discussed by Elias et al. (1978). Their results showed the long-term variability in the infrared and possible correlation with the variations in the Balmer emission lines.

The long-term variability of the hydrogen lines has been studied for long time (see Peton, 1972 for references). This type of variability was further documented by Slettebak and Reynolds (1978), Elias et al. (1978), Hubert-Delplace and Hubert (1979), Barker (1979, 1984) and by Andrillat and Fehrenbach (1982).

o Cas is included in the photometric campaign on Be stars proposed by Harmanec et al. (1982). It has been observed with the 0.65m telescope of the Hvar Observatory since 1982. The photometric behaviour of the star is illustrated in Figure 1. The photometric variability is well pronounced and rapid (at least in certain periods).

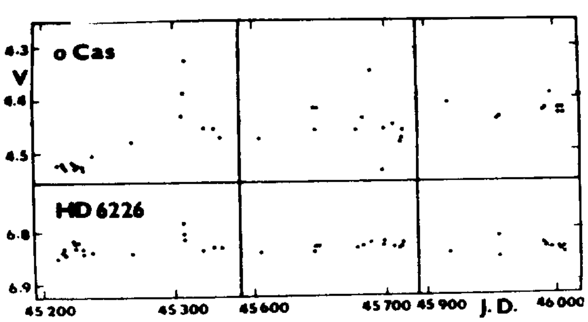

Figure I

The V magnitudes of o Cas and HD 6226 (check star) measured differentially against comparison star HR 189 (V = 5.68) versus J.D.

The results of the photometric monitoring prompted spetroscopic observations of the star. Three spectra were secured on two consecutive nights with the coudé spectrograph of the 2m RCC telescope at Rožen National Astronomical Observatory, Bulgaria. We used IIa 0 emulsion. The reciprocal dispersion was about 9A/mm. In Figure 2, we show two normalized intensity profiles of Hβ. The date of the exposure is given in the left part of the figure.

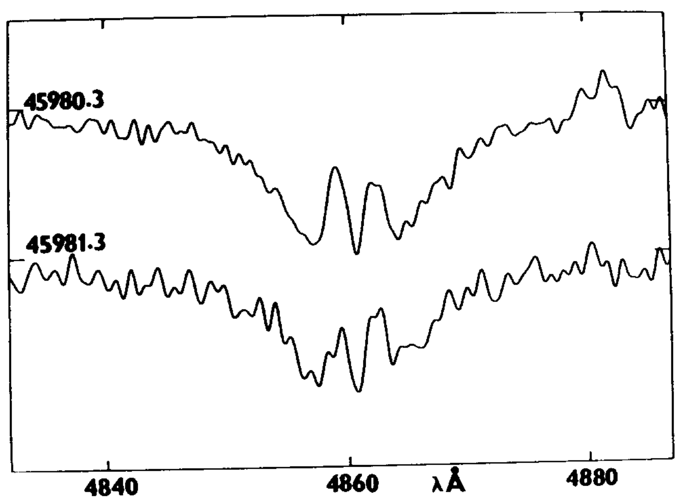

Figure 2

Hβ profiles of o Cas taken on two consecutive nights.

It is readily seen that the inversion of the emission line ratio occured in the Hβ profile of o Cas within 24 hours.
Due to the scheduling problems we were not able to arrange for simultaneous spectroscopic and photometric observations. Therefore, it is not clear whether there is a correlation between V/R variation and photometric behaviour of the star.

We have found two hints at possible rapid variability of o Cas in the literature. Gomez and Abt(1982) reported possible change in the profile of HeI 5876 A in 3 days and Slettebak and Reynolds (1978) quote the paper by Butler (1975) where he allegedly found variations with a time scale of the order of 1 day in Hα narrow-band photometry. But it seems that this evidence is not very strong since the values are given in the graphical form and o Cas is not mentioned in the text (while other stars are).

The V/R change is one of the most conspicuous type of change in the spectrum of Be stars. The largest survey of the V/R variability so far has been presented by Copeland and Heard (1963). This study is concerned with slow cyclic V/R variations because it is based on spectra of 60 Be stars which were observed about once a year over a 24-year interval.

Since 1970 a great deal of evidence have been accumulated for the existence of V/R variability (including the inversion of the emission line ratio) over much shorter time-interval.

Dachs et al. (1981) observed 36 bright southern Be stars and disclosed rapid V/R variations visible in the Balmer emission line profiles of four stars. Other cases of rapid variability of V/R ratio were described by Baade (1984).

Little is known about the character of the rapid variability of V/R ratio. Regular behaviour of the V/R was reported by Peters (1972) during the periodic two-component shell phase in the Be star HR 2142. Baade (1982) was able to prove that in the Be star 28 CMa the V/R follows strictly the 1.365-day period. There are other reports of the possible short-period variations of V/R ratio (LQ And - Baade et al. 1984, EM Cep - Harmanec, 1984) but these conclusions need further confirmation.

The changes of V/R ratio in the spectrum of o Cas pointed out in this communication are very similar to those described in the above mentioned papers.

We tried to look for possible correlation between the V/R variation and radial-velocity changes.

First, we analyzed the data by Abt and Levy (1978). The harmonic analysis of their values disclosed a number of shorter periods which lead to comparable orbital solutions. We have not included old available RV of o Cas (Lick and Victoria Observatories) due to the fact that these measurements were made on classical Abbé comparators, while Abt and Levy (1978) used the whole line profile for determination of the position. Unfortunately it was not possible to analyze the data by Elias et al.(1978) either due to the fact that they publish rounded dates only. But it seems that even this material supports the possibility of much shorter period of radial-velocity variation (nearly full range of radial velocity during 54 days).

We measured all 3 spectra for radial velocity (the method was similar to that described by Abt and Levy, 1978). These velocities were combined with data by Abt and Levy (1978) and by Elias et al. (1978) and orbital solution for the fixed original value of period (1033^d) was computed. The appropriate velocity curve is shown in Figure 3a. In Figure 3b we present the radial-ve-

Figure 3 a

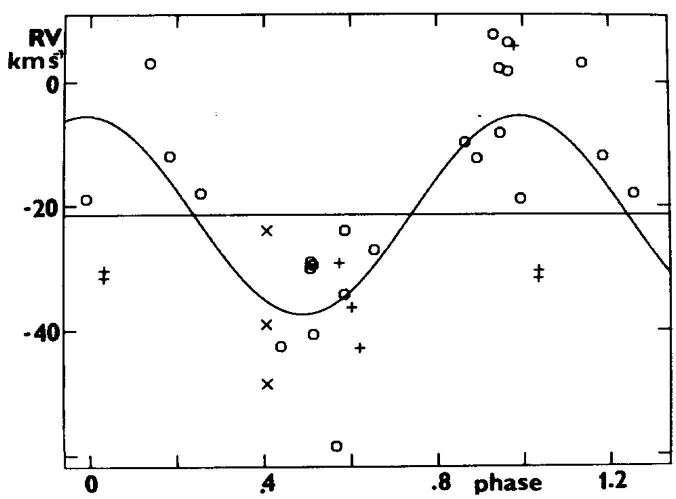

Figure 3 b

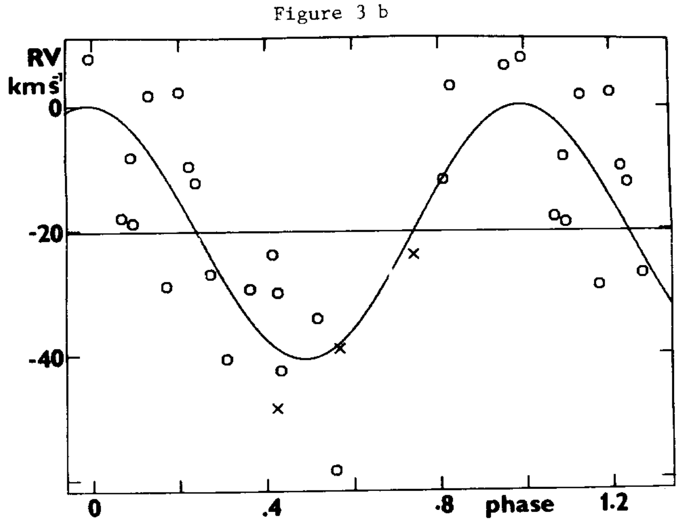

Figure 3

Computed velocity curves (solid lines) and individual measured velocities (0-Abt and Levy, 1978; X- this paper, + Elias et al. 1978) for o Cas;
a) represents the solution for the fixed period 1033^d
b) the same for the period 1.1679^d (data by Elias et al. 1978 not used).

locity curve corresponding the orbital solution based on our measurements and data by Abt and Levy (1978). The value of the period is 1.1679^d. Clearly, the correlation between V/R ratio and radial velocity cannot be ruled out.

It seems that the number of Be stars showing rapid V/R variability might be much higher than is known now. The main reason is that most of the observational material is severely undersampled in time (see Dachs et al., 1981 or Barker, 1979).

We would like to use this note as challenge to people interested in rapid variations of Be stars to concentrate on V/R ratio. One should collect the observational material needed for answering the following questions:

1) What is the typical time scale of the rapid V/R variation?
2) What is the fraction of the Be stars showing periodic short-term V/R variation?
3) Are there Be stars which display only long-term V/R variation?
4) Are there any correlations between light, radial-velocity changes and V/R variations?

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SPECTRA OF FLARE STARS

Spectra of eight flare stars have been obtained at the Bulgarian National Astronomical Observatory at 50 and 200 Å/mm. The 2m telescope was equipped with a cassegrain spectrograph with a cooled Vidicon detector (Tsvetkov and Markov 1984), and produced spectra with a resolution between 2.5 Å and 5 Å. Exposure times varied between 2 and 20 minutes. All observations were done between March 9 and March 11, 1983. We present the observed results in Table I and in the Figure.

Table I

Star	Gliese No.	Hydrogen Balmer line emission	Ca II H and K emission
AD Leo	388	Yes	Yes
BF CVn	490 A	Yes	-
V1054 Oph	644 AB	Yes (a)	Yes
CU Cnc	G9-8	Yes (a)	Yes
VW Com	516 A	No	No
-	516 B	No (b)	No (b)
V774 Her	718	No	-
V654 Her	-	No	No

a) Structure in Hα emission line. Spectroscopic binary.
b) Noisy spectrum, low signal-to-noise.

The first three stars in the Table are well known flare stars and their spectra show hydrogen Balmer lines as well as Ca II H and K lines in emission. CU Cnc also has a typical flare star emission line spectrum. Several flares have been recorded photographically (Haro et al. 1975, Jankovics et al. 1978) and photoelectrically (Pettersen 1982). The Figure shows the spectral region around Hα. The emission line shows indication of splitting, a feature that had disappeared the next night. We suggest that CU Cnc is a spectroscopic binary. Some structure was also seen in the Hα emission line profile of V1054 Oph, thus supporting the binary suggestion by Pettersen et al. (1984).

The last four stars in Table I show no sign of emission in either the hydrogen Balmer lines or the Ca II H and K lines. Photoelectric light curves of flares have been published for all stars (Gliese 516 A and B were observed jointly during the flare). The flare activity of V774 Her was confirmed by Chugainov (1984), and V654 Her was shown to be a giant by Tsvetkov and Pettersen (1984). Together with the objects discussed by Pettersen and Griffin (1980), several non-emission line flare stars have now been identified.

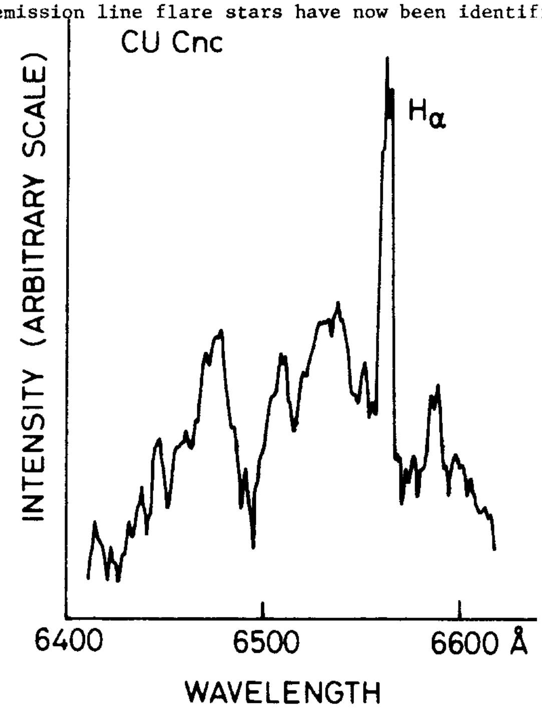

Figure 1

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CORRELATION BETWEEN THE MEAN AMPLITUDE OF THE FLARES AND THE LUMINOSITY OF THE FLARE STARS

It was pointed out (Mirzoyan et al., 1977) that there exists a correlation between the mean observed amplitudes and the minimum magnitudes of the flare stars in Pleiades (see Table I) . This correlation could be explained in terms of observational selection.

In the case of photographic observations all flares brighter than the plate limit can be registered if the amplitude $\Delta m \geq 0^m\!.5$ .However, the mean amplitudes of the observed flares are highly increasing towards the fainter stars below the plate limit. It is obvious that this increase can be the result of a selection effect. In their study, Mirzoyan et al. (1977) evaluated the probable mean amplitude of the flares on those stars which are below the plate limit in the minimum light. They concluded that the mean amplitude of the flares was strongly decreasing when ever fainter stars were considered (see Table I, values corrected for selection).

In this note the results of a more detailed study concerning the correlation between the mean amplitude and the luminosity of the flare stars are given, using the flares observed in U light in Pleiades, Orion and the solar neighbourhood.

Figure 1 shows how the mean amplitude of the flares (averaged in $1^m\!.0$ wide intervals) depends on the luminosity. Crosses and dots are used for denoting the flares in Orion and Pleiades, respectively. The solid lines 1 and 2 in Figure 1 can be considered as lines of constant energy. It is obvious that a given amount of the flare energy will result in a smaller amplitude flare on a more luminous star than on less luminous stars. It is worth mentioning that the flare stars in Orion are considered as being at the distance of Pleiades in the Figures 1 and 2.

As can be seen in Figure 1, at the plate limit the amplitudes of the flares are subjected to a strong increase. Similarly to the estimation by Mirzoyan et al. (1977) we estimated the number of the faint flares lost at the faint stars. The results allowed us to use a correction for the mean value of the amplitude of faint flare stars. Finally the curves 5 and 6 were obtained

	Mpg(min)	13^m-14^m	14^m-15^m	15^m-16^m	16^m-17^m	17^m-18^m	18^m-19^m	19^m-20^m	20^m-21^m	$\geq 21^m$
Δpg	observed	$1^m.2$	$1^m.2$	$1^m.2$	$1^m.4$	$2^m.0$	$3^m.2$	$4^m.0$	$5^m.0$	$6^m.0$
	corrected	1.2	1.2	1.2	1.4	1.6	1.6	1.6	1.7	1.7

Table I
Mean amplitudes of the flares

instead of observed curves 3 and 4 (see Figure 2). As can be seen in Figure 2 (curves 5 and 6) the mean values of the amplitudes became almost constant for all the stars. Neither the very small flares on the bright flare stars nor such flares on faint flare stars were taken into account, although the number of the latter flares has to be much greater.

These results show that the mean amplitude is almost constant, and even if it is increasing towards the faint flare stars, it cannot be represented by the curves 1 and 2 (see Figure 1). Moreover, if the small amplitude flares on the faint stars lost due to the observational selection are not taken into account, at those parts of the curves 3 and 4 where the observational selection is not considerable, the mean amplitude is either constant or (in the interval $11^m.5-17^m.5$) varying very slightly.

In order to make a comparison, the relation between the mean amplitude ($\Delta\bar{U}$)and the absolute magnitude of the flare star in the minimum (M_V) can be examined for the UV Ceti stars using Moffett's (1974) observational data. This relation is seen in Figure 3. For each of the 8 flare stars the amplitudes were averaged. The size of the circles in Figure 3 depends on the number of the flares. The mean amplitude is almost independent of the luminosity of the flare star.

Just to be confirmed in the reality of the above conclusion, again Moffett's (1974) observational results are used. For the sake of simplicity only the brightest (YY Gem) and the faintest (CN Leo) flare stars are considered here. Moffett (1974) calculated the energy in the U band for 6 flares on YY Gem ($M_V = 8^m.36$) and for 101 flares on CN Leo ($M_V = 16^m.55$). The mean energy of one flare on these stars is as follows:

$$\bar{E}_{U\ (YY\ Gem)} = 10^{33.02} \quad \text{erg},$$

$$\bar{E}_{U\ (CN\ Leo)} = 10^{28.36} \quad \text{erg}.$$

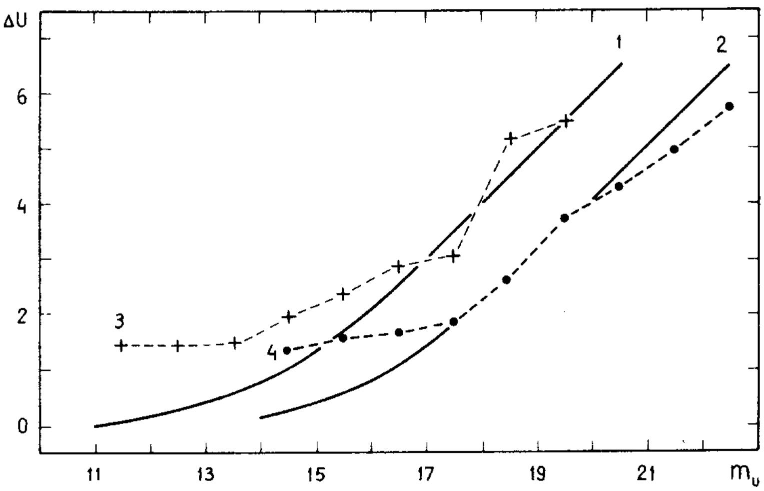

Figure 1

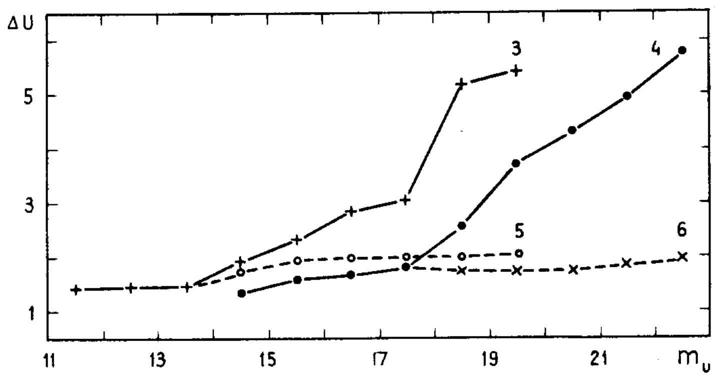

Figure 2

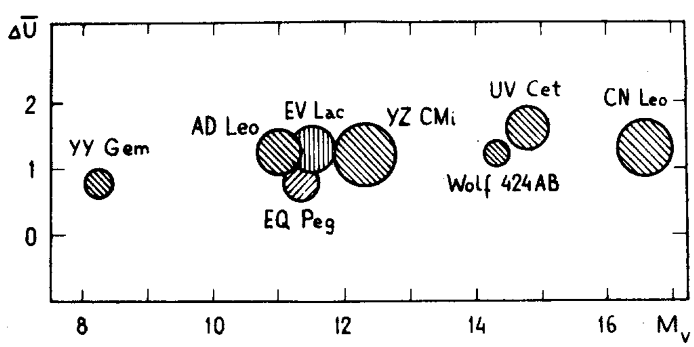

Figure 3

The ratio of these values is

$$\frac{\bar{E}_U \text{ (YY Gem)}}{\bar{E}_U \text{ (CN Leo)}} = 10^{4.66}$$

This means that the mean energy of one flare on YY Gem is more than 45 000 times larger than that of CN Leo. This number is larger by approximately one order of a magnitude than their luminosity ratio in the U band.

The independence of the mean flare amplitudes means that for equal amplitudes the ratio of the energy liberated in flares of stars with different luminosities is equal (in average) with the ratio of the luminosities of these stars. Therefore, if we consider the energy of the flare, the brighter stars are more active.

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RECENT PHOTOMETRY OF THE HELIUM-WEAK STAR V396 PERSEI

V396 Persei = HR 1063 is important as the only helium-weak star known to be photometrically variable. We began photometry at the request of Shore (1983), whose spectrophotometry in the far ultraviolet with I.U.E. showed peculiar CIV line profiles varying in phase with the 2.5-day photometric (= rotational) period (Shore and Brown 1984). Although the period has been redetermined as $2^{d}.4928$ by Mallama and Molnar (1974), the precision of that value still was not sufficient to compute reliable phases at the epoch of the I.U.E. spectrophotometry a decade later. Therefore we redetermined the light curve during the winter of 1983-1984, to provide a recent, more nearly concurrent time of maximum light.

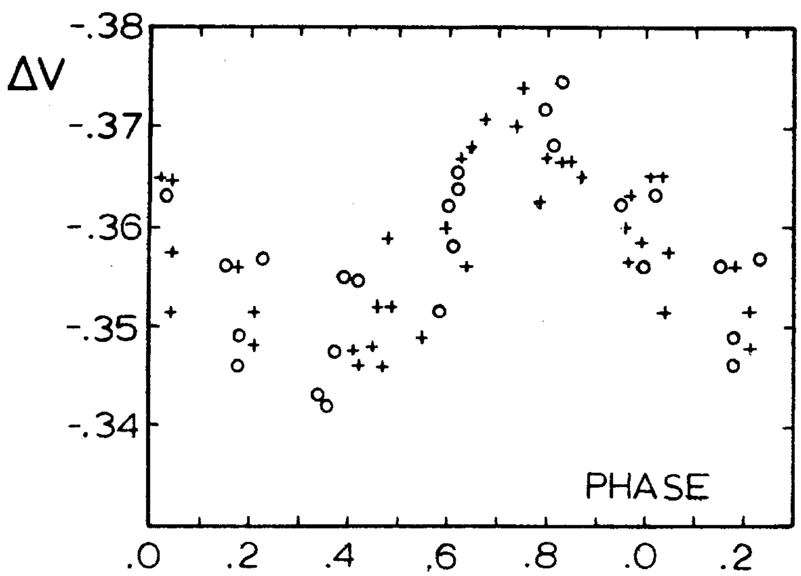

Figure 1

Our 1983-1984 light curve of the helium-weak star HR 1063. ΔV is differential magnitude in the sense variable minus HR 1051 and phase is computed with the ephemeris in equation (1). Each symbol is a mean of 3 or 4 individual differential measures, where o is Landis and + is Louth. The total amplitude is only 0.02 magnitude and maximum brightness occurs around phase 0.75.

Differential photometry was obtained at two observatories in the V bandpass using HR 1051 as the comparison star. Landis observed with his 8-inch telescope on 18 nights between JD 2445675.5 and 2445739.5. Louth observed with his 11-inch telescope on 22 nights between JD 2445667.6 and 2445747.6. The individual differential magnitudes, corrected for differential atmospheric extinction and transformed differentially to V of the UBV system, have been deposited in the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1982), where they are available as File No. 139. Means of 3 or 4 individual ΔV values are plotted in Figure 1 versus phase computed with the ephemeris

$$JD(hel.) = 2441245.962 + 2\overset{d}{.}4928\ n \qquad (1)$$

taken from Mallama and Molnar (1974), where the initial epoch corresponds to a time of maximum light.

In Figure 1 we see the total amplitude is approximately $\Delta V = 0\overset{m}{.}02$, the same seen in the top part of figure 1 of Winzer (1974). The phase of maximum light is approximately $0\overset{P}{.}75$, the displacement from $0\overset{P}{.}00$ not surprising because of the uncertainty in phase accumulated over the last decade. We have not analyzed our light curve in more detail because there has been some question about the exact value of the photometric period, as was discussed by Mallama and Molnar (1974). Our photometry in Archive File No. 139 is, however, available for reanalysis if that proves necessary.

The rms deviation of the points in Figure 1 from a best fit of the light curve is around $\pm\ 0\overset{m}{.}003$, and any systematic difference between Landis and Louth is not more than about $\pm\ 0\overset{m}{.}001$. Differential photometry of this accuracy was possible because every pertinent factor was nearly ideal. The variable and the comparison star are comfortably bright ($V = 5\overset{m}{.}5$ and $V = 5\overset{m}{.}8$, respectively), similar in brightness ($\Delta V = -0\overset{m}{.}36$), very close together in the sky ($\rho < 0\overset{\circ}{.}3$), and very similar in color ($\Delta(B-V) < 0\overset{m}{.}1$). Moreover, the differential airmass was always extremely small ($\Delta X < 0.01$) and the transformation coefficients for the two observers were very small ($\epsilon = -0.01$ for both Landis and Louth) and reliably determined.

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HD 200776 : A NEW ECLIPSING BINARY IN CYGNUS

HD 200776 has been found to be an eclipsing variable with a period of 3.0239 days and primary and secondary eclipse depths in V of 0.43 and 0.40 magnitudes respectively.

There has been previous evidence for the star's variability. McCrosky and Whitney (1982) found abrupt decreases in brightness on five occasions in 1980-2, though they stated that the phases were not consistent with a simple eclipse model. Also, Abt et al. (1972) noted that the star was a single-lined spectroscopic binary of 2.9258 day period and calculated a preliminary orbit.

HD 200776 was observed on 22 nights during July-November, 1984 and B and V magnitudes with the single-channel photon-counting photometer (which utilizes an uncooled EMI 9924A photomultiplier tube) and 0.6-m. telescope of the Corralitos Observatory. HD 200595 ($V \doteq 6.48$; $(B-V) = -0.15$) was chosen as the comparison star (the same used by McCrosky and Whitney). SAO 50404 was used as a check of its constancy. Measurements showed that the magnitude differences between check and comparison stars were constant at :

$$\text{(check - comparison)} \qquad \Delta V = 1.374 \pm .018 \text{ (s.e.)}$$
$$\Delta(B-V) = .053 \pm .017$$

Instrumental magnitude differences were converted to BV magnitudes by observations of standard stars.

The observations soon revealed that HD 200776 is an eclipsing binary with a secondary eclipse nearly as deep as that of the primary. Two complete primary and two secondary minima were observed , along with portions of others, giving a preliminary ephemeris of:

$$\text{JD (prim. min.)} = 2445960.6758 + 3.0239\ E$$

Primary minima were observed on JD 2445960.6758 and 63.6986 and secondary minima on 2446010.6101 and 13.6351.

The period found is slightly different from that of Abt et al. This would account for the difficulty of McCrosky and Whitney in fitting their observations to an eclipse model based on the spectroscopic period. In this study, no

Table I: Comparison - variable magnitudes

JD (2440000+)	V	(B-V)	JD (2440000+)	V	(B-V)
5911.7465	-1.25	-.17	5964.6938	-1.25	-.18
5911.7611	-1.23	-.20	5964.7438	-1.23	-.17
5911.7750	-1.25	-.19	5967.6368	-1.25	-.18
5939.7229	-1.33	-.15	5967.6799	-1.24	-.19
5939.7347	-1.28	-.11	5967.6910	-1.23	-.17
5956.6479	-1.25	-.17	5985.6167	-1.29	-.18
5957.6611	-1.67	-.15	5985.6903	-1.28	-.17
5957.6715	-1.65	-.15	5985.7521	-1.28	-.20
5957.6826	-1.61	-.16	5985.7625	-1.24	-.20
5957.6924	-1.60	-.13	5987.5854	-1.27	-.16
5957.7028	-1.53	-.16	5987.6479	-1.27	-.16
5959.6799	-1.25	-.14	5987.6778	-1.30	-.16
5959.6903	-1.22	-.21	5987.7014	-1.35	-.18
5959.7014	-1.22	-.19	5987.7278	-1.34	-.15
5959.7125	-1.24	-.19	5992.5785	-1.36	-.16
5959.7229	-1.24	-.20	5992.6056	-1.35	-.16
5959.7340	-1.23	-.18	5992.6319	-1.36	-.15
5960.6021	-1.47	-.16	5992.6604	-1.33	-.17
5960.6118	-1.50	-.15	5992.6931	-1.35	-.16
5960.6222	-1.53	-.16	5992.7208	-1.28	-.16
5960.6326	-1.57	-.15	6009.5639	-1.28	-.15
5960.6431	-1.59	-.16	6009.6104	-1.27	-.14
5960.6813	-1.67	-.16	6010.5701	-1.58	-.19
5960.6917	-1.64	-.17	6010.5903	-1.63	-.18
5960.7021	-1.60	-.19	6010.6118	-1.65	-.14
5960.7486	-1.48	-.15	6010.6368	-1.63	-.16
5960.7583	-1.38	-.14	6010.6667	-1.52	-.15
5961.6688	-1.27	-.17	6012.5785	-1.26	-.17
5961.6785	-1.26	-.19	6012.6174	-1.25	-.15
5961.6882	-1.24	-.18	6012.6729	-1.26	-.15
5961.7396	-1.27	-.14	6013.5618	-1.47	-.17
5961.7507	-1.22	-.19	6013.5813	-1.53	-.15
5961.7903	-1.27	-.19	6013.6021	-1.61	-.13
5961.8007	-1.24	-.12	6013.6222	-1.63	-.17
5962.6326	-1.24	-.19	6013.6438	-1.63	-.17
5962.6625	-1.25	-.19	6013.6667	-1.61	-.12
5962.7444	-1.23	-.18	6013.6917	-1.53	-.15
5962.8042	-1.26	-.17	6013.7132	-1.47	-.12
5962.8146	-1.25	-.17	6025.5646	-1.34	-.17
5963.6000	-1.39	-.18	6025.5840	-1.33	-.16
5963.6104	-1.43	-.15	6025.6021	-1.35	-.16
5963.6215	-1.45	-.17	6025.6292	-1.37	-.16
5963.6340	-1.48	-.17	6025.6486	-1.39	-.16
5963.6444	-1.52	-.16	6025.6819	-1.54	-.12
5963.6549	-1.57	-.16	6025.7035	-1.57	-.15
5963.6674	-1.61	-.14	6025.7278	-1.64	-.16
5963.6813	-1.62	-.19	6031.5694	-1.32	-.18
5963.6938	-1.64	-.15	6031.5986	-1.31	-.16
5963.7069	-1.64	-.16	6031.6639	-1.36	-.19
5963.7403	-1.57	-.16	6031.6938	-1.39	-.16
5963.7528	-1.61	-.17	6033.5632	-1.29	-.20
5963.7639	-1.52	-.15	6033.6000	-1.29	-.19
5963.7757	-1.45	-.21	6033.6389	-1.29	-.14
5964.6431	-1.26	-.17	6034.5771	-1.32	-.15
5964.6542	-1.24	-.18	6034.6368	-1.31	-.15

estimates of error are given in the values of the primary minima or period since so few minima were observed.

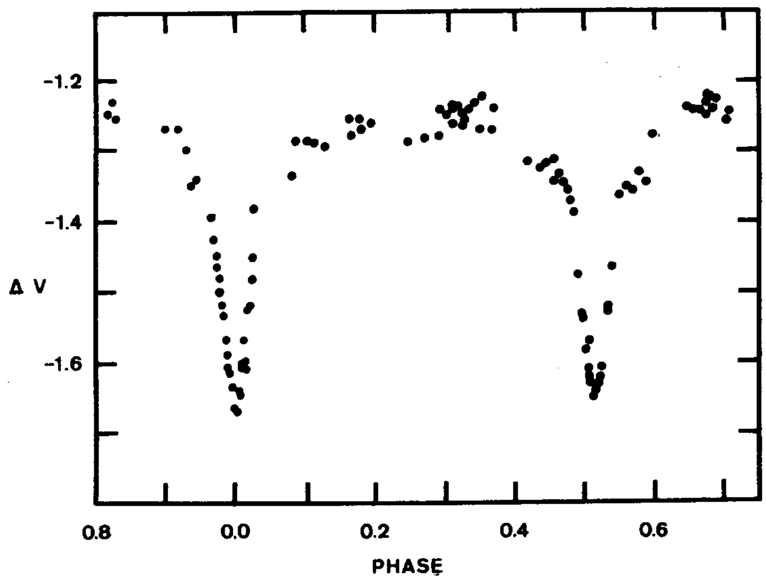

Figure 1 : Variation in magnitude for HD 200776 as a function of phase. ΔV is in the sense of V (comparison) - V (variable).

The phase diagram of the differential V magnitude values (comparison - variable) appears in Figure 1 and the magnitude differences in Table I.

Abt et al. give a spectral type of B1 IVp for the system and Buscombe and Kennedy (1974), one of B2 III. As there is little or no color change (the mean differential B-V = -0.16) during the cycle and from a consideration of the f(m) value calculated by Abt et al., it seems likely that the secondary star is of B/early A spectral type.

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THE BEHAVIOUR OF FG Vul IN 1984

The semiregular variable M5II-star FG Vul, which is a member of the old open cluster NGC 6940 (Götz, 1981, 1984) was measured in B (ORWO ZU21+GG13+BG12) on 13 plates obtained with the 50/70/172 cm Schmidt camera of Sonneberg Observatory covering the time interval between 23 April 1984 and 13 December 1984 (Götz).

In addition, photoelectric observations in U, B and V from 8 nights between 8 July 1984 and 30 October 1984 were obtained (Luthardt).

The sequence of comparison stars used is given by Götz (1984). In that paper the magnitudes m_B of FG Vul are not corrected concerning extreme colour influences. Admitting a mean difference $B-m_B=-0.47$ mag, which results from two nearly synchronous photographic and photoelectric measurements the former observations of FG Vul can be reduced to B-magnitudes. In the present paper the corrections given are taken into account.

The photoelectric observations are linked to the star No. 100 of the list of Vasilevskis and Rach (1957). Its photometric parameters $V = 10^m.44$, $B-V = +0.74$ and $U-B = +0.44$ are given by Walker (1958). The individual observations of FG Vul obtained in 1984 are listed in Table I and Table II.

Table I
Photographic observations in 1984

J.D. 244...	B	244...	B
5814.57	$10^m.83$	5946.41	$11^m.01$
5815.58	11.03	5973.43	10.90
5818.58	10.93	6000.36	10.35
5822.57	11.01	6003.37	10.85
5871.47	10.83	6034.23	11.20
5935.43	10.85	6048.25	11.07
5940.42	10.89		

Table II
Photoelectric observations in 1984

J.D. 244...	V	B-V	U-B
5890.53	$9^m.31$	$1^m.73$	$1^m.37$
5903.53	9.16	1.74	
5916.48	9.02	1.76	1.45
5925.45	9.07	1.72	
5926.51	9.07	1.75	1.44
5935.53	9.13	1.75	1.35
5946.47	9.25	1.74	1.25
6004.31	9.03	1.74	

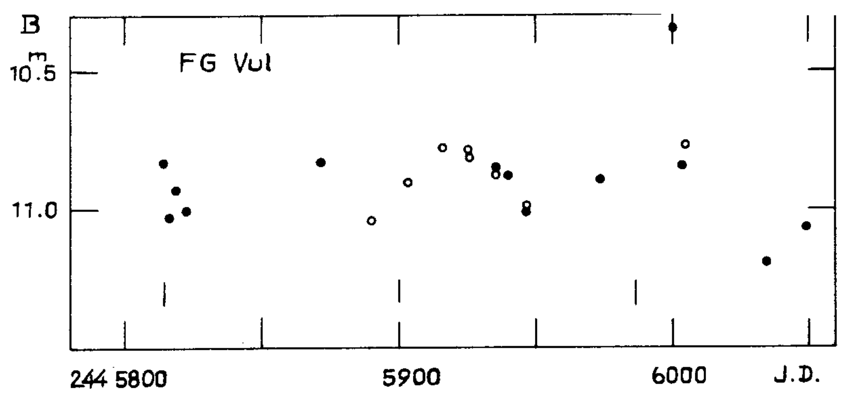

Figure 1

The light curve of the star in 1984 is given in Figure 1. The photoelectric observations are marked by circles there. The dates of minima, which can be expected according to the preliminary elements given by Götz (1984) are also marked in this Figure.

Comparing the given light curve with that of the year 1983 it can be seen that in 1984, apart from one observation ($B=10^{m}.35$) the mean amplitude of the star became smaller ($\Delta B \approx 0^{m}.4$). But also in this case the light curve is characterized by well defined minima, which are arranged in irregular succession.

The regularities known from light curves of former years are lost and only the minimum at J.D. 244 5890 can approximately be presented by the given elements ($0-C \approx -10^{d}$).

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A POSSIBLE NEW FLARE STAR IN THE PLEIADES (M 45) REGION

Probably a new flare star in M45 region has been discovered in the course of a photographic survey made with the 16 cm f/5.7 astrograph of the Osservatorio astronomico di Pieve S. Paolo (Lucca) during the autumn 1979. I revealed this object only in October 1983, and a careful plate analysis made by prof. L. Rosino (1984) at Asiago Astrophysical Observatory has proved that the object is very probably a new flare star. The flare star catalogue of Haro et al. (1982) and IBVS from October 1979 onward have been consulted, but the object does not coincide with previous known flare stars. The object lies quite near to TON. new ser. No. 366 = B 539 (about 1'NE).

Deep infrared plates taken with the 67/92 cm Asiago Astrophysical Observatory Schmidt camera are empty in the position of this suspected new flare star. Its position has been measured with a micrometer at the Istituto di Astronomia dell'universita di Pisa.

Its coordinates are: $\alpha = 3^h43^m\!.3$; $\delta = +25^\circ08' \pm 0'\!.3$ (1900)

Plate parameters: date - 19 October 1979; T.U. (middle exposure) - 21^h48^m
exposure time - 50 min; emulsion - HP4 (Ilford)

The object has a panchromatic magnitude (at max.) ≃ 13.

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Many thanks are due to prof. L. Rosino for the kind interest and helpful suggestions. Thanks are also due to the personnel of the istituto di astronomia dell'universita di Pisa for the use of the micrometer.

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ON THE TYPE OF VARIABILITY OF THE STAR H42 IN THE ANDROMEDA GALAXY

Hubble (1929) classified H42 as a cepheid. Baade and Swope (1965) gave a period $P = 176\overset{d}{.}68$ on the basis of extensive observations. The light curve of H42 shows significant dispersion, particularly large in the minimum - up to 1^m. Cepheids in M31 usually have a dispersion smaller than $0\overset{m}{.}4$. Hence Baade and Swope considered the light curve of H42 as unstable and Sharov and Kholopov (1979) confirmed this conclusion. The above mentioned authors, however, considered the type of H42 as undefined. The luminosity of H42 corresponds to the period – luminosity relation. That is why this star is usually referred as a cepheid.

The aim of this paper is to show that H42 is a cepheid-like semi-regular star and to call attention to the very long period cepheids with $P > 50$ days, as well.

We redetermined the magnitudes of the comparison stars of H42 using three of the best plates obtained by the 2m telescope of Rozhen Observatory. The results are given in Table I. Our magnitudes of the B and C comparison stars are about $0\overset{m}{.}5$ fainter than Baade and Swope's ones. This difference must not be explained as a systematic variation in the magnitude scale. Baade and Swope's and our magnitudes of the comparison stars coincide (Ivanov, 1985 Fig.2). The stars B and C are exceptions.

Table I

Comparison star	A	B	C	D	E	F	G
B mag. (present paper)	17.7	18.9	19.2	19.7	20.0	20.3	20.6
Mag. (Baade and Swope)	17.7	18.4	18.7	19.6	19.83	20.31	20.62

We tied the magnitudes of Baade and Swope's observations to the comparison stars in Table I. We have evaluated B magnitudes of H42 using 17 plates (Table II). Our measurements are based on Arp's photoelectric standards in Baade's Field IV (Baade and Swope, 1963). We determined the period of H42 using a period-finding computer programme. Our period $P = 176\overset{d}{.}74$ coincides with that of Baade and Swope. We attempted to find periods using separately

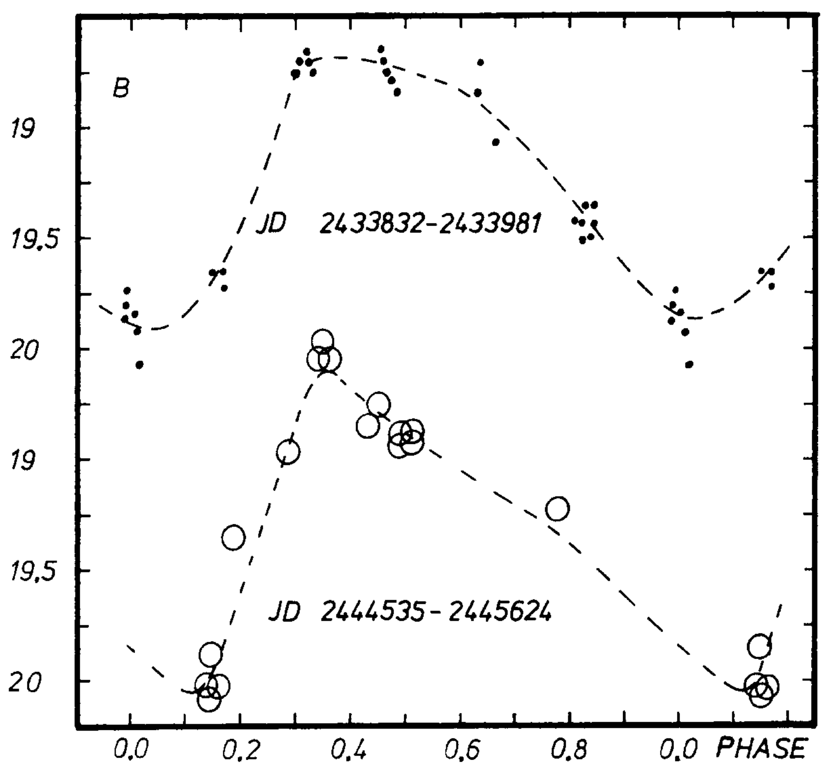

Figure 1

Table II

Photometry of H 42

J.D. 2440000+	B	J.D. 2440000+	B	J.D. 2440000+	B
4534.96	$19^m.35$	5284.24	$18^m.85$	5347.31	$19^m.23$
4881.56	20.05	5288.47	18.75	5622.48	18.55
4881.62	20.07	5295.25	18.94	5623.27	18.55
4882.42	19.88	5295.35	18.92	5623.35	18.55
4882.48	20.05	5296.25	18.92	5624.30	18.48
5242.59	18.98	5296.32	18.93		

the observations made by the following authors: Hubble (1929), Baade and Swope (1965), Sharov and Kholopov (1979) and our observations, as well. The period $176^d.74$ satisfies best the observations of the various authors. We conclude that the period has been constant. Both the amplitude and the shape of the light curve varied for the separate cycles (Figure 1). Our computer programme did not find any secondary period in the variations of the individual curves. The accidental variations are typical for the semi-regular stars.

In the Baade's Field III the cepheids with $P > 10^d$ show concentration to the inner edge of the arm S4 (Efremov, 1980). The location of H42 to the outer edge of the arm is not normal for the long period cepheids.

By our observations we obtained $\langle B \rangle = 19.5$. The absorption A_B in the region of H42 is varying from 0.8 to 1.2 (Ivanov, 1985). If we accept $(m-M)_o = 24.2$ for M31, we would obtain $M_{\langle B \rangle}$ from -5.5 to -5.9 . The period — luminosity relation predicts $M_B = -6^m.7$. It is well known that cepheids with $P > 100$ days do not lie in the straight line of the period— luminosity relation but below it. The luminosity of H42 is near that of the cepheids. However, there is not any explanation for the abnormal decline of the cepheids with $P > 100^d$ from the linear period— luminosity relation. We suppose that the luminosity of variables with $P > 100^d$ is not a convincing argument to refer H42 as a cepheid.

We have examined cepheids with $P > 50^d$ in the Magellanic Clouds. Neither the photoelectric observations nor the photographic ones give evidence for unstable light curves.

Recently Sasselov (1984) supposed the existence of a possible new type semi-regular variable, UU Her, which has a luminosity near that of the cepheids. H42 reminds of UU Her variables but both its amplitude and the shape of the light curve differs from the values typical of the UU Her stars.

A similar example in the Galaxy is the variable S Vul. This star is classified as a semi-regular one in the General Catalogue of Variable Stars (Kukarkin et al., 1969-1970). The visual light curves of Beyer (1930) support its belonging to the semi-regular stars. These visual observations cover 29 cycles. About ten individual light curves are well outlined. However, each one of the following authors: Fernie (1970), Mahmoud and Szabados (1980) made 20 observations and they suggested that S Vul was a classical cepheid. The photoelectric observations covered 6 cycles each but they did not outline well any individual light curve. Hence, these observations are insufficient for showing any variation in the shape of the light curve. The luminosity of S Vul is $M_V = -6.9$ (Caldwell, 1983). The radius obtained by the Wesselink method is $R = 249 \pm 11 R_\odot$. The values of M_V and R correspond to the respective values of cepheids. The O-C diagram in the paper of Mahmoud and Szabados, however, shows a 25-year cycle inherent to the UU Her stars. We consider the belonging of S Vul to the classical cepheids as a doubtful one.

We are grateful to D.D. Sasselov for the valuable discussion concerning the variable S Vul.

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FURTHER RADIAL VELOCITY MEASUREMENTS OF HD 36705

In an earlier note (IBVS Number 2571) we reported that the radial velocity of the spotted late type star HD 36705 appeared to vary periodically with an amplitude of approximately 10 km s^{-1}. As Collier (1982) had identified HD 36705 as a member of the FK comae class (Bopp and Stencel, 1981), which are possibly highly evolved coalesced contact binaries, this was an interesting result. The small radial velocity variation found for HD 36705 suggested an extreme mass ratio ($q < 0.1$) . Possibly this was a system in the last stages of coalescing.

However, new measurements obtained with the 1.0 m telescope at Siding Spring observatory in 1984 October do not reproduce the earlier variation. The 17 measurements give a mean of 29.5 km s^{-1}, with an rms spread of 5.0 km s^{-1}, in very good agreement with the measurements of Collier (1982).

We note that our earlier measurements may have been affected by distortions in the line profiles due to the spots on the star (eg Fekel, 1983). Our photometry from the two epochs shows the amplitude of the photometric wave was larger by about a factor of two during the first measurements compared with the latest.

We also note that observations of the 13th magnitude optical companion of HD 36705, Rossiter 137B, show Ca II H and K, Hϵ and Hα as strong narrow emission lines characteristic of a dMe star, and that 4 radial velocity measurements obtained in October 1984, and one further point in December 1984, give a mean radial velocity of $\sim$28 km s^{-1} with a small spread. This suggests that Rossiter 137B is probably physically associated with HD 36705.

2

We acknowledge discussion with Dr Collier concerning HD 36705. A fuller discussion of the above results will appear elsewhere.

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PHOTOMETRY OF THE 1984 ECLIPSE OF 22 VULPECULAE

The well-known spectroscopic binary 22 Vul (HD 192713, $\alpha = 20^h15^m\!.5$, $\delta = 23°31'$ (2000)), was found by Parsons and Ake (I.B.V.S. 2334, 1983) to show eclipses of its hot component, one of which was predicted by their ephemeris to occur in late August - early September 1984, centred at JD 2,445,940.4. Due to the large difference in visual luminosity between the components the eclipse was expected to be quite shallow in V, but the large temperature difference was predicted to yield a deeper eclipse in the U band.

We obtained UBVRI photometry of this event using the 0.5 m telescope and multichannel photometer of the Climenhaga Observatory. Since the observations described by Scarfe et al (I.B.V.S. 2545, 1984) were made, the EMI 6256 tube has been replaced by an EMI 9658, enabling observations in R and I to be made. Mean coincidence, extinction and transformation coefficients were used to correct the differential magnitudes to the standard system defined by the work of Landolt (A.J. 88, 439, 1983).

Since early 1984 the photometer operations, including filter dwell-time, star-sky switching, and data logging, have been controlled by a Commodore 64 micro-computer, using programs written by one of us (R.M.R.).

Unfortunately we did not get any observations before the eclipse, nor any during the partial phases. However we are able to make a few deductions from even such fragmentary observations as ours, and we felt it would be useful to publish them, and the observations as well, as a contribution to future studies of the light curve.

The comparison star used was HD 192712, and the check star was HD 192342, for which UBV photometric data are available from the USNO Catalogue (Blanco et al., Pub. U.S. Naval Obs. 2nd Ser., 21, 1968). Data for 22 Vul itself, which must have been obtained outside eclipse, are obtained from Comm. L.P.L. 4, pt3, 1966. The data are:

	V	B-V	U-B	V-R	R-I
22 Vul	5.15	1.04	0.71	0.74	0.48
HD 192712	7.15	1.04	0.72		
HD 192342	6.50	0.26	0.06		

Our observations of 22 Vul are given, differentially with respect to HD 192712, in Table I. Each is an average of two to five individual integrations, each of which in turn involved four or five full cycles of the filter wheel, for a total of about 10 seconds per colour per integration.

Table I: The observations

J.D. 2445900 +	ΔU	ΔB	ΔV	ΔR	ΔI
37.84	-1.64	-1.79	-1.95		
38.77	-1.65	-1.79	-1.96	-2.00	-2.05
40.77	-1.64	-1.77	-1.95	-1.99	-2.03
41.82	-1.66	-1.83	-1.97	-2.00	-2.08
42.77	-1.65	-1.82	-1.95		
45.75	-1.64	-1.79	-1.95		
50.79	-2.05	-1.96	-2.02		
52.69	-2.01	-1.93	-2.01	-2.03	-2.06
53.75	-1.99	-1.93	-1.99		
57.73	-2.00	-1.94	-2.01		
72.70	-2.01	-1.94	-2.00		

It is clear that on the first six nights the hot component was in eclipse but that it was not on the remaining nights. Parsons and Ake (B.A.A.S. 17, 913, 1985) found the time of mid-eclipse to be J.D. 2445942·3 ± 0.2, somewhat later than previously predicted. Using this we find, on the assumption of symmetrical eclipses:

1. Duration of totality > $9^{d}_{\cdot}0$
2. Duration of partial phases < $4^{d}_{\cdot}0$
3. Duration of eclipse < $17^{d}_{\cdot}0$

These are in reasonable agreement with the results of Parsons and Ake.

We derive the following depths of the eclipse in each band (in magnitudes) by averaging the individual observations.

$$\Delta U = 0.367 \pm 0.007$$
$$\Delta B = 0.142 \pm 0.006$$
$$\Delta V = 0.052 \pm 0.004$$
$$\Delta R = 0.031 \pm 0.006$$
$$\Delta I = 0.010 \pm 0.015$$

To get UBV colours for the components we may adopt the published data for either HD 192712 or for 22 Vul out of eclipse. The latter are for a brighter star and we adopt them as probably being more reliable, as well as including R and I observations. From them we obtain the following results for the cool (G3 Ib-II) and hot (B9) components and for the comparison star, but our observations of the check star are insufficient for this to be done reliably for it too.

	G	B	Comparison
V	5.20 ± 0.01	8.47 ± 0.09	7.16 ± 0.01
B-V	1.13 ± 0.01	0.00 ± 0.10	0.97 ± 0.01
U-B	0.94 ± 0.01	-0.21 ± 0.06	0.78 ± 0.01
V-R	0.76 ± 0.01	0.18 ± 0.24	0.73 ± 0.01
R-I	0.50 ± 0.02	-	0.44 ± 0.02

The results for the B star are in satisfactory agreement with those for an unreddened B9V star, or for a B8V star reddened by E(B-V) = 0.09 magnitudes. The absolute V magnitudes of such stars are close to 0.0 mag., and indicate that of the G star to be about -3.3 mag., in good agreement with its luminosity class. The distance of the system must be about 500 pc.

Finally we note that the good agreement between observations taken about 20 days apart after the end of the eclipse suggests that the light curve outside eclipse should be fairly flat and not greatly affected by circumstellar matter in the system.

We hope to observe future eclipses, and ultimately obtain full multicolour light curves. We thank D.W. Forbes for drawing our attention to 22 Vul.

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Hα EMISSION IN RS CVn STARS: BD+61° 1211 AND HD 37847

In addition to the 33 RS CVn stars (Liu Xuefu and Tan Huisong, 1984), other 29 RS CVn stars were observed in the Hα region using the Coude Reticon system of the McDonald Observatory 2.1 m telescope. The dispersion is 9.5Å/mm and the resolution is 0.29Å. These observations were made in Nov. and Dec., 1984. Two of the observed stars, BD+61° 1211 and HD 37847, showed Hα emission. The basic data are listed below.

Star	Sp.	Period (day)	Obs.J.D.(H) 2446000+	Phase	H E.W. (mÅ) emis.	absor.
BD+61° 1211	late G or early K	7.492	35.9513	0.830	2040	0
			36.0367	0.842	2030	0
			36.8954	0.956	2000	0
			36.9929	0.969	1840	0
			37.9963	0.10[illegible]	2923	0
HD 37847	F(pri.) G8III(sec.)	-	33.7954	-	60	100
			34.7838	-	0	464
			35.7433	-	0	835
			36.7408	-	0	767
			36.7788	-	0	767
			37.9229	-	0	564

BD+61° 1211=DM UMa=SAO 015339, has been indentified as the optical counterpart to the x-ray source 2A1 052+606 by Liller (1978). He found by HEAO-1 that this binary has moderate Hα emission. Crampton (1979) also observed the Hα emission using a scanner with 8-10Å resolution.

We report here five high-resolution observations (Figure 1), all of them show strong emission. It is known that HR 1099, II Peg, HD 8357 and BD+61° 1211 are the objects to emit both hard and soft x-rays and always show Hα emission. This is characteristic of only the most active RS CVn stars.

HD 37847 has no Hα emission reported yet. The Hα profiles in this paper show gradual change over five nights (Figure 2). Hα emission appears slightly above the continuum only during the first night. Obviously, the absorption component is filled up by the emission one since the equivalent width of the absorption component of Hα is much less than that of the normal star in the same spectral type and luminosity class.

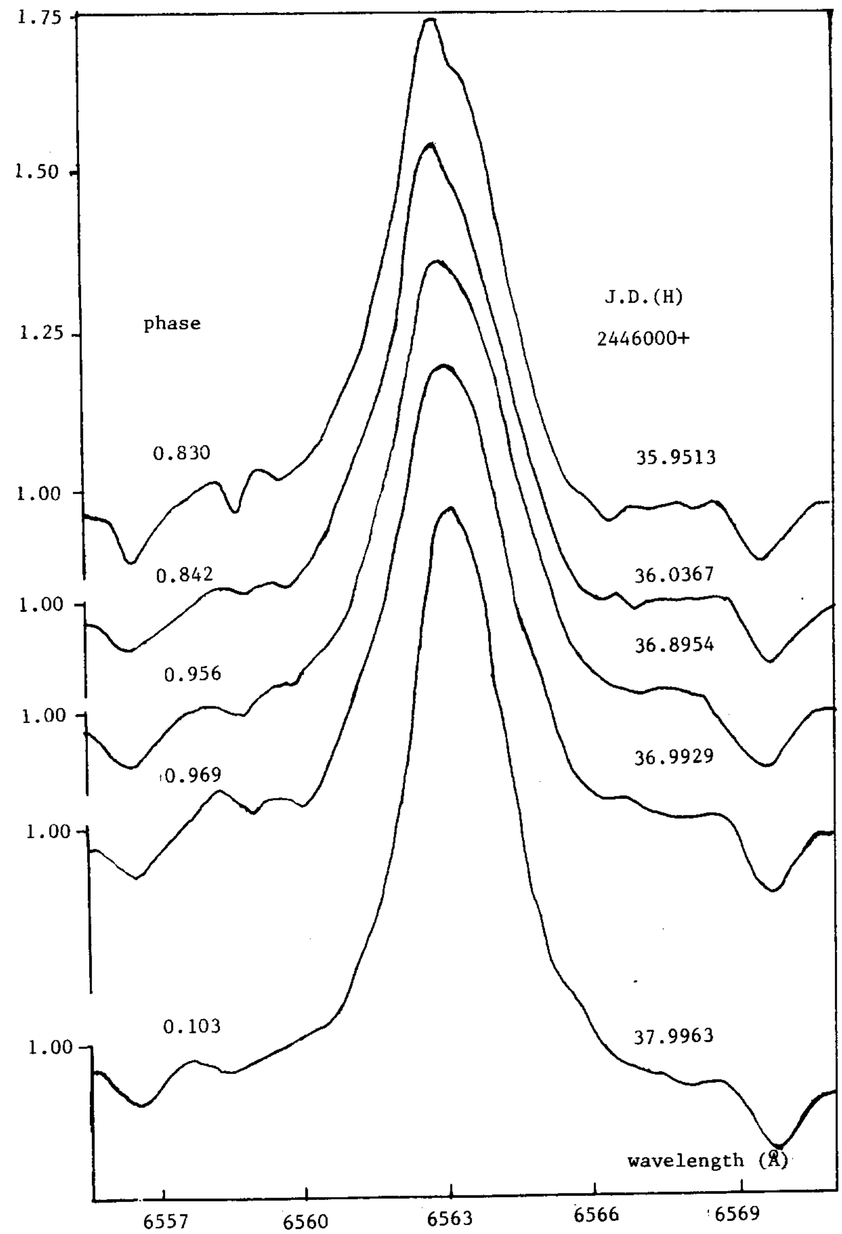

Figure 1. H_α emission feature of BD+61°1211

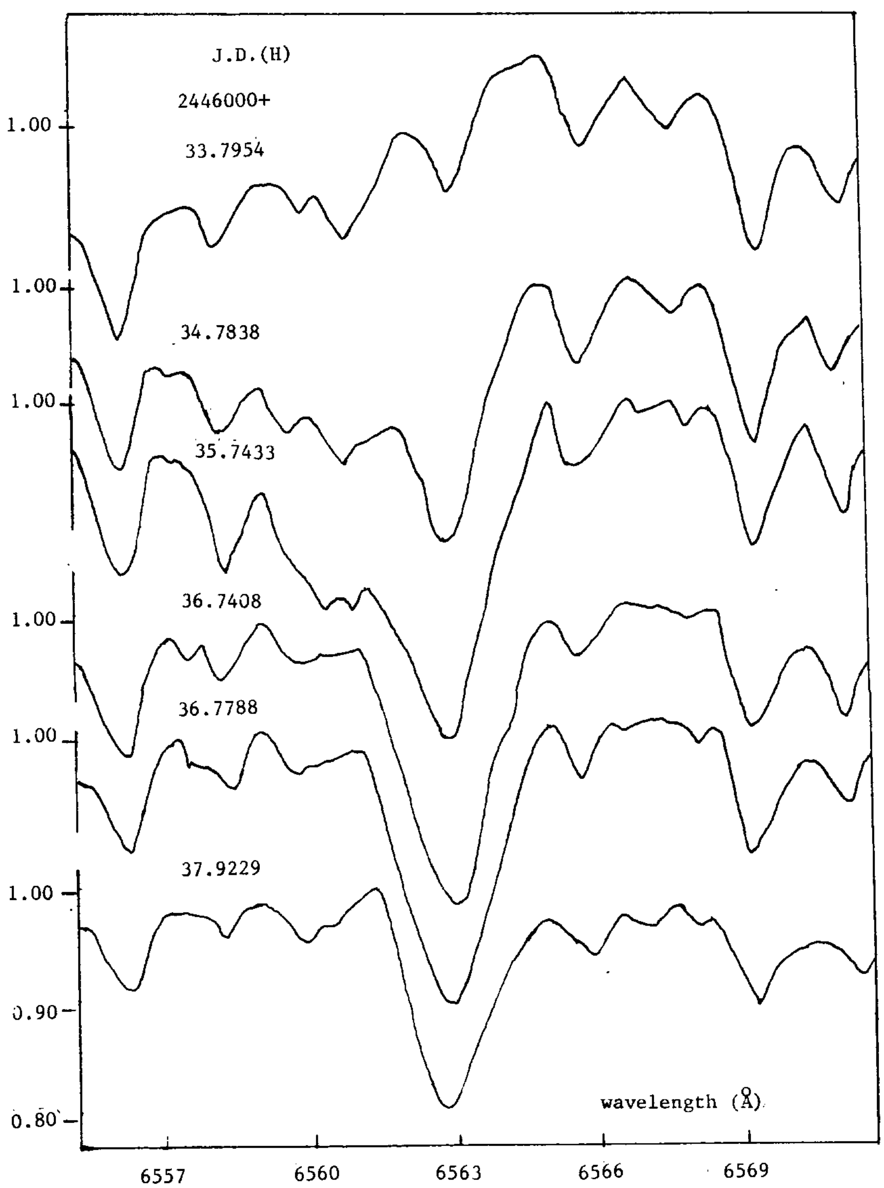

Figure 2. Hα emission feature of HD 37847

We are grateful to Dr.H. Smith for scheduling the telescope time.

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PERIOD CHANGE IN THE ECLIPSING BINARY SYSTEM V471 TAURI

V471 Tauri (BD + $16^{\circ}516$) is an eclipsing binary consisting of a K2V star and a white dwarf. A summary of observations of the system was presented by Young et al. (1983). Three eclipses of the system were observed during the 1983 and 1984 seasons at the Erwin W. Fick Observatory.

The observations were obtained with a two-channel photoelectric photometer at the f/16 Cassegrain focus of the Fick Observatory 61 cm reflector. A dichroic filter reflects wavelengths shorter than 6300 angstroms to an EMI 6256 photomultiplier with a U band filter. The second (Red) channel, which is directed to a Hamamatsu R926 photomultiplier, is used to compensate for changing sky conditions and guiding errors. Simultaneous pulse counting of the outputs in both channels occurs with an integration time of 4 seconds.

The ratio of the U channel counts to the Red channel counts, with mean sky level subtracted, was analyzed using a simple three-line model least squares linear fit to each ingress and egress observed. Although this method will not accurately give the duration of the ingress or egress, it will indicate the midpoint of the ingress or egress, from which the eclipse midpoint time can be determined. The following parameters are tabulated in Table I:

t_{mid} = observed heliocentric time of mid-eclipse.

$O-C_1$ = the difference between t_{mid} observed and predicted by the eclipse midpoint ephemeris of Young and Lanning (1975): JD=2440610.0649+0.52118346 E, where E is the epoch number of the eclipse.

$O-C_2$ = the difference between t_{mid} observed and predicted by the ephemeris of Young et al. (1983): JD=2441913.02368 + 0.521182993 E', where E'=E-2500.

Table I : Results of eclipse timings of V471 Tauri

UT Date	Epoch(A)	t_{mid} (JD-2440000)	$O-C_1$(sec)	$O-C_2$(sec)
12/3/83	9712	5671.79559± 0.00006	-265.3± 5.6	14.5± 5.6
11/2/84	10355	6006.91642± 0.00005	-277.5± 4.7	28.2± 4.7
11/22/84	10391	6025.67892± 0.00005	-286.6± 4.6	20.6± 4.6

(A) as given by the ephemeris of Young and Lanning (1975).

Figure 1 is a plot of $O-C_1$ vs. epoch, for the data in Table I (crosses) and data from Ibanoglu and Evren (1984) (circles). The solid line indicates the O-C expected from the ephemeris of Young. et al. (1983).

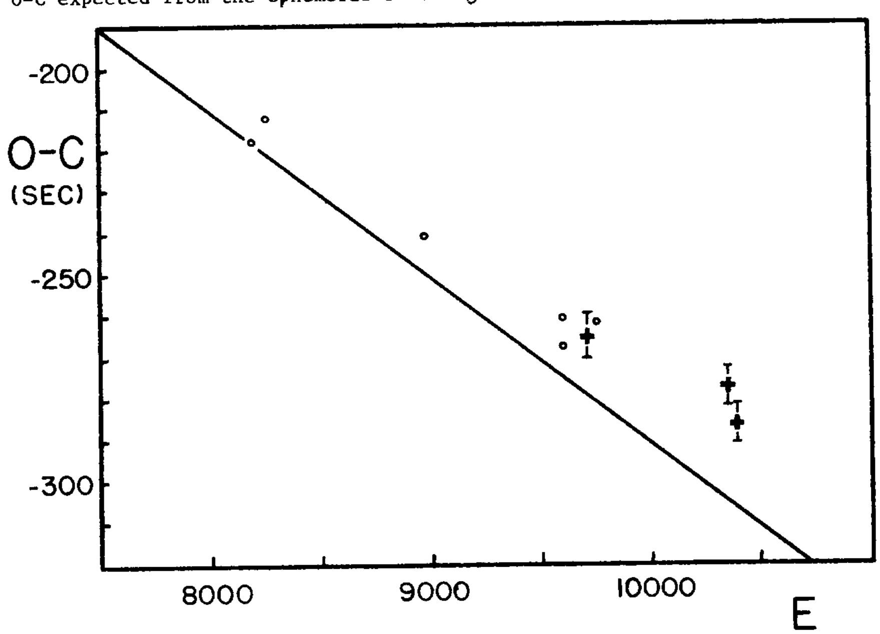

Figure 1 : $O-C_1$ vs. Epoch.

Oliver and Rucinski (1978) suggested that observations between epochs 3000 and 5000 were best fit with a linear O-C ephemeris. Linear O-C fits were subsequently used to calculate ephemerids by Young et al. (1983) for observations between epochs 3000 and 7500, and by Ibanoglu and Evren (1984) for observations between epochs 2700 and 10000. We notice that as later observations are included, the implied period increases. The observations presented here diverge from the linear O-C fit, as can be seen in Figure 1.

It appears that the period has been increasing slowly since epoch 7000, and the last two observations indicate the rate of change is increasing.

The author expresses his appreciation to Mr. J. J. Eitter for his assistance with the instruments employed in this work.

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A NEW PHOTOELECTRIC TIME OF MINIMUM FOR VZ Psc

In 1984 VZ Psc was observed on the night of August,26-27 at Merate Observatory. Instruments,procedures and comparison stars are the same described in IBVS 2487, where 1983 measures are discussed.

Observations started at JD .455 and were interrupted by clouds at JD .536 : the measures (all in V light) are not of top quality, but a minimum can be determined at JD hel. 2445939.499 ($\sigma = \pm 0.001$) using Kwee and Van Woerden's method (1956). The ΔV value at minimum light is 0.48, i.e. the same of the minimum showed in Fig.1 of the IBVS 2487.

Having respect to the complete light curve given by Davidge and Milone (1984) these two minima appear to be secondary.

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TIMES OF MAXIMUM LIGHT OF THE DELTA
SCUTI STAR CY Aqr

Recently Rolland et al. (1985), and Purgathofer and Schnell (1984) carried out an analysis of the Delta Scuti star CY Aqr including not only their observations, but a compilation of about 350 times of maximum light. With these times of maxima, that covered a time span of about fifty three years they concluded that the best ephemeris was

$$T_{max} = \text{HJD}2440892.6370 + 0.0610381318 \cdot E - 4.58 \times 10^{-13} E^2.$$

New observations were carried out at the 1 m telescope of the Observatorio de Tonantzintla, Puebla, Mex., with a two-channel high-speed photometer in the white light and an integration time of ten seconds to achieve the highest accuracy possible in determination of the times of maximum light. The star was observed on the nights of 21, 28 and 29 December, 1984.

When these maxima were included in the analysis similar to that described in Rolland et al. (1985) the results were the following :

$$T_{max} = \text{HJD}2440892.63705 + 0.0610383201 \cdot E - 4.45 \times 10^{-13} E^2.$$

Table I shows the residuals of the O-C analysis and Figure 1 shows graphically their corresponding values.

Table I

Observed times of maximum light of CY Aqr in 1984

Times of max.light (HJD-2400000.0)	Epoch	O-C (day)	O-C (min)
46055.5612	84 585	0.0010	1.435
46062.5806	84 700	0.0010	1.438
46063.5571	84 716	0.0009	1.320

We feel that this and other stars of this kind have to be monitored continuously to decide unequivocally on its accurate period variation.

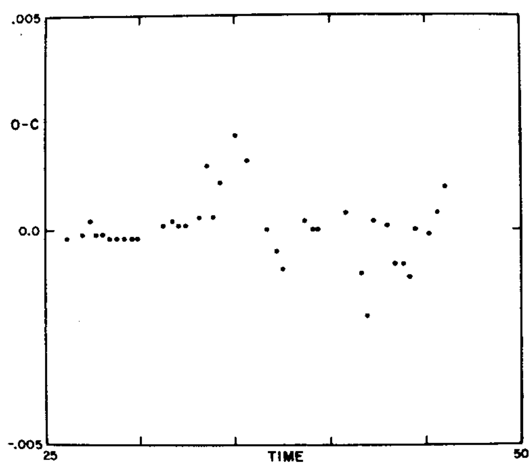

Figure 1 : O-C vs time diagram with the ephemeris derived in the present study. The O-C axis is in units of day fraction whereas the abscissa, time is in days/1000.

We would like to thank D.Flores for his assistance in the Heliocentric correction, to A.Garcia for the drawing and to R.Escamilla for the typing. J.Miller proofread the text.

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CRITICAL OBSERVATIONS VS. PHYSICAL MODELS FOR CLOSE BINARY SYSTEMS*

BEIJING, CHINA
First week of November, 1985

The Scientific Organizing Committee (SOC) consists of:

Wang, Shouguan, Co-chairperson, Beijing Observatory, Academia Sinica, Beijing, China;

Leung, Kam-Ching, Co-chairperson, Behlen Observatory, University of Nebraska, Lincoln, NE 68588-0111, U.S.A.;

Cowley, Anne P., Department of Physics, Arizona State University, Tempe, AZ 85287, U.S.A.;

Huang, Runqian, Yunnan Observatory, Academia Sinica, Kunming, China;

Paczynski, Bohdan, Princeton Observatory, Princeton University, Princeton, NJ 08544, U.S.A.;

Qu, Qinyu, Department of Astronomy, Nanjing University, Nanjing, China;

Tong, Fu, Purple Mountain Observatory, Academia Sinica, Nanjing, China;

Wilson, Robert E., Department of Astronomy, University of Florida, Gainesville, FL 32611, U.S.A.;

Zhai Disheng, Beijing Observatory, Academia Sinica, Beijing, China.

At the moment, the committed invited speakers are:
H.A. Abt, A.P. Cowley, R.H. Koch, Y. Kondo, K.C. Leung, L.B. Lucy, B. Paczynski, F.H. Shu, R.F. Webbink, and R.E. Wilson.

For those who are interested in participating or receiving more information about the Beijing Meeting, please contact a member of the Scientific Organizing Committee.

KAM-CHING LEUNG

* Sponsored by the U.S. National Science Foundation and the Academia Sinica

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IS CD HERCULIS = BD + 46^{o} 2308 VARIABLE?

To clarify the behaviour of the variable star CD Her = BD + 46^{o}2308 Dr. Samus' (Moscow) asked us to observe this star photoelectrically and on the Sonneberg plate material.

Discrepancies in the existing papers concerning both the identification and the spectral type were already discussed by Samus' (1984).

Previous observations made on the photographic plates of the Babelsberg Observatory by Prager (1931) showed irregular variations in the range of $11^{m}.2$ ... $12^{m}.5$. To confirm these observations Kroll (1983) estimated the star on the same plates used by Prager (which are now at Sonneberg) and on plates of the Sonneberg Sky Patrol. He also found variations between $11^{m}.3$ and $12^{m}.5$. A search for a hidden period was not successful.

In order to get more accurate data I observed CD Her photoelectrically in U, B and V with the Sonneberg 60 cm mirror II during 17 nights in 1984. Only small variations of some hundredth of a magnitude were visible (see the Table). If these are real, they are nevertheless too small to confirm the estimations by Prager and Kroll. The cause of this discrepancy is as yet unclear.

Table. Photoelectric observations of CD Her

J.D.	ΔV	ΔB	ΔU
244 5780	$-0^{m}.02$	$-0^{m}.10$	-
5782	0.00	-0.01	-
5783	-0.05	-	-
5810	-0.01	-	-
5822	-0.01	-	-
5890	-0.02	-0.09	$-0^{m}.16$
5903	-0.03	-0.08	-
5912	-0.01	-0.10	-
5913	-0.04	-0.07	-
5916	-0.04	-0.10	-0.13
5925	-0.02	-0.07	-0.15
5926	-0.02	-0.10	-0.17
5930	-0.02	-0.10	-
5935	-0.05	-0.09	-0.10
5936	-0.05	-0.11	-
5944	-0.03	-0.05	-
5946	-0.03	-0.03	-

The magnitude differences are in the sense CD Her minus comparison star, which is situated 7ʹ.7 NW of the variable (see the finding chart given by Samus' (1984)). In addition, the red star Z of that chart has been checked occasionally; 10 observations also do not point to any significant variability.

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DISCOVERY OF ECLIPSES AND LONG-PERIOD VARIABILITY
IN THE TRIPLE SYSTEM HR 6469

HR 6469 was recognized as a triple system when McAlister et al. (1983) resolved it with speckle interferometry. The spectrum was already noted as composite by Wilson (1966) and as SB2 by Cowley and Bidelman (1979). Later speckle interferometry by McAlister et al. (1984) showed rapid orbital motion consistent with a 5.53-year period determined spectroscopically by F. C. Fekel. C. T. Bolton, in a private communication to Bopp (1984), suspected the short period to be "a few days". Fekel (1984) obtained spectrograms with the Kitt Peak coude feed telescope and CCD detector at red wavelengths. From those observations he estimated that the single star in the long-period orbit has a G5 IV spectral type, the primary in the short-period orbit is an F7 V star, and no lines of the secondary in the short-period orbit could be seen. Previous classifications, of the composite spectrum of this triple system, have been inconsistent: G0III, F8V, F9V, G0Vn:, F9Vn:, and dF8.

HR 6469 was placed on a list of bright suspected variable stars by Hall (1983) because reports of its Ca II H and K emission suggested it might be an RS CVn-type variable. Weak H and K emission was first noted by Wilson (1966) and its flux later measured by Middelkoop (1982) and by Bopp (1984). The profile in figure 8 of Bopp (1984) shows the emission indeed is weak.

In this note we present 427 differential magnitudes obtained photoelectrically by 7 different observers on 123 nights between JD 2445151.6 and 2445874.8 in V of the UBV system using HR 6444 as the comparison star. Table I is a tally of those observations. Each individual observation was bracketed between two observations of the comparison star. The resulting differential magnitudes, corrected for differential atmospheric extinction and transformed differentially to the UBV system, have been sent to the I.A.U. Commission 27 Archive of Unpublished Observations of Variable Stars

TABLE I

Tally of Observations

Observer	Observatory	Aperture	Nights	Observations
Boyd	Fairborn	10-inch	43	121
Brooks	Brooks	12.5-inch	3	8
Fried	Braeside	16-inch	45	124
Hoff	Northern Iowa	16-inch	2	5
Lines	Lines	20-inch	5	63
Stelzer	Stelzer	14-inch	10	35
Wasson	Sunset Hills	8-inch	15	71

(Breger 1982), where they are available as File No. 150. Most entries represent individual differential measures whereas some represent means of 3 differential measures, so all are not of equal weight. Brooks and Hoff had not determined their transformation coefficients so we made their ΔV values brighter by $0^m.02$ and fainter by $0^m.05$, respectively, to fit the light curve defined by the other five observers. This procedure, we presume, provided an effective transformation.

Unexpectedly our photometry showed that HR 6469 is an eclipsing binary. We determined a preliminary ephemeris of

$$\mathrm{JD(hel.)} = 2445839.83 + 2^d.230\ n \tag{1}$$

for the primary minima. After discovery of the eclipses, Boyd and Wasson covered primary eclipse by continuous observation on three nights, and Lines did the same for secondary on two nights. These Boyd and Wasson light curves, shown in Figure 1, were used to derive an improved value for the midpoint of primary eclipse. To take advantage of our 2-year baseline, we analyzed all other points occurring very near primary or secondary minima, thereby improving our estimate of the period. The resulting ephemeris

$$\begin{aligned}\mathrm{JD(hel.)} = 2445839.&813 + 2^d.2299\ n \\ \pm.&001 \quad \pm^d.0001\end{aligned} \tag{2}$$

should be used for predicting times of future primary minima.

When we plotted our 2 years of photometry versus Julian date, with points within $\pm\ 0^P.04$ of the minima excluded, we found another unexpected result: a long-period variability with a total amplitude of $\Delta V = 0^m.04$.

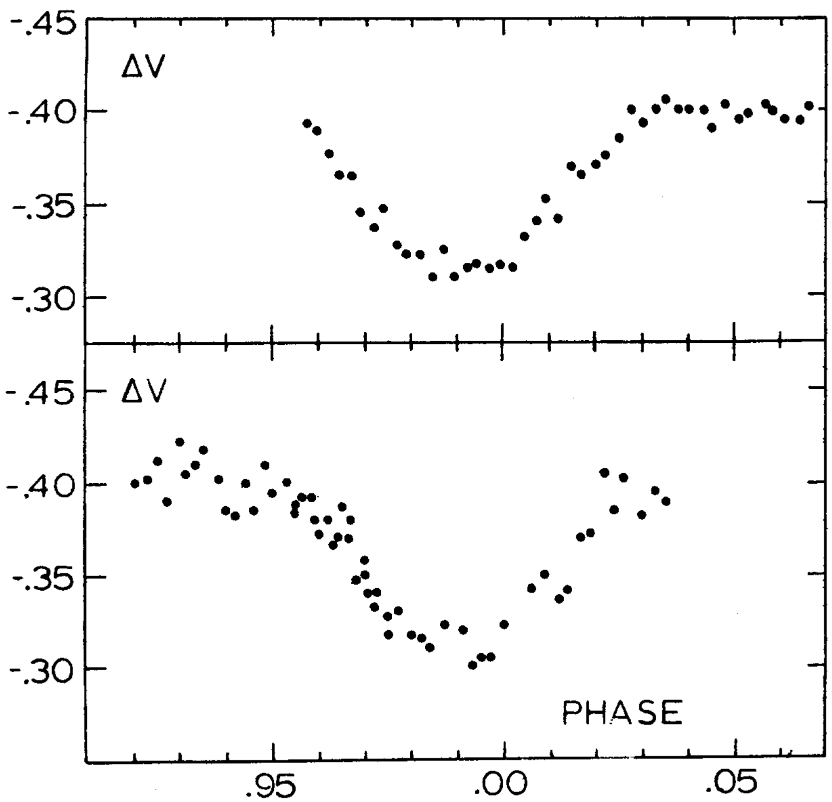

Figure 1

Primary eclipse of HR 6469 observed on one night by Boyd (upper) and on two nights by Wasson (lower). Phase is computed with the preliminary ephemeris in equation (1). The true midpoint, around 0.991 phase, was used for the initial epoch of the revised ephemeris in equation (2). Eclipse depth is around $\Delta V = 0.085$ magnitude and the eclipse duration is $D = 0.08$ phase = 4.3 hours. It cannot be decided whether the eclipses are partial or complete.

Times of minimum brightness, determined graphically from the light curve, were fit by linear least squares to yield an ephemeris of

$$\begin{array}{ll} \mathrm{JD(hel.)} = 2445164 + 83\overset{d}{.}2\ n \\ \qquad\qquad\quad \pm 4 \qquad \pm\overset{d}{.}7 \end{array} \qquad (3)$$

for times of minimum light. This long-period variation is shown in Figure 2. Boyd observed the comparison star HR 6444 differentially 183 times with respect to the check star 69 Her on 88 nights in all bandpasses of the UBV

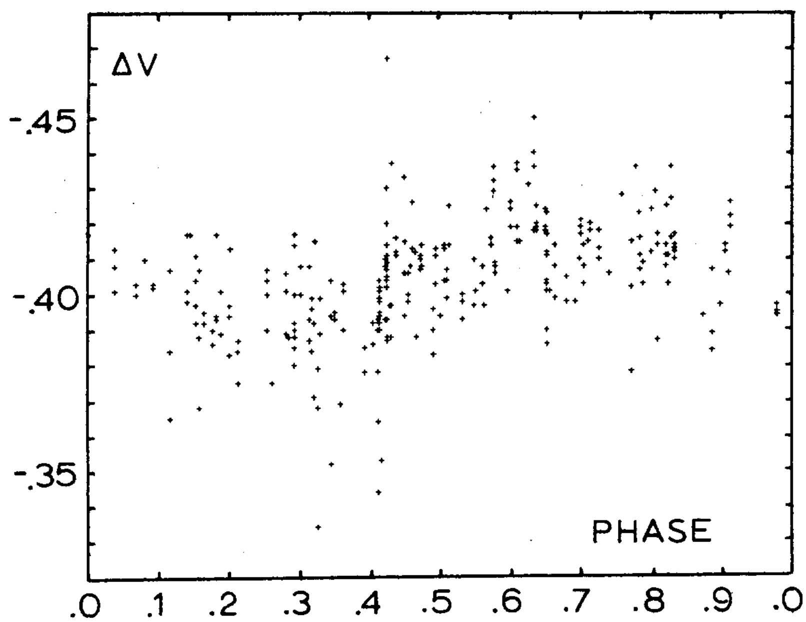

Figure 2

The light curve of HR 6469 outside eclipse, i.e., points within 0.04 phase of either mideclipse excluded. Phase is computed with the 83.2-day period in equation (3), but the origin is such that minimum light falls at approximately 0.3 phase. The variation, of total amplitude ΔV = 0.04 magnitude, probably arises from the G5 IV component of the triple system.

system. Analysis showed these differential magnitudes were not correlated with the ephemeris in equation (3); this convinced us that the $83^{d}.2$ variability is intrinsic to HR 6469. Although 69 Her is a suspected variable (CSV 101643 = NSV 8489) with a range of $4^{m}.60 < V < 4^{m}.66$, our check-minus-comparison differential magnitudes showed an rms deviation of only $\pm 0^{m}.010$ from the mean.

Before plotting the eclipse light curve, we removed the $0^{m}.04$ long-period variation by adding to each differential magnitude the quantity

$$d = 0^{m}.02 \sin \{ 360^{o}(JD-2445185) / 83^{d}.2 \} , \qquad (4)$$

assuming the variation can be approximated by a sinusoid. The resulting eclipse light curve is shown in Figure 3.

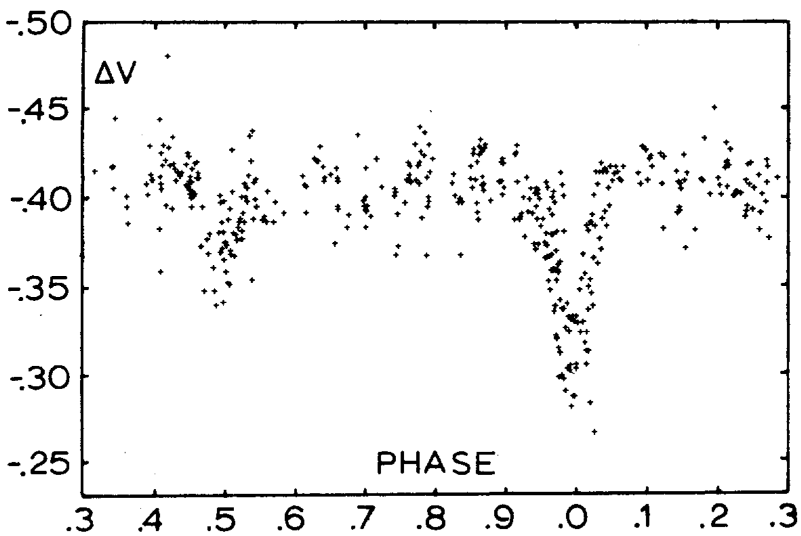

Figure 3

The light curve of HR 6469 showing primary and secondary eclipse of the F7V + ? close pair in the triple system. Phase is computed with the 2.23-day orbital period. The long-period variation seen in Figure 2 has been removed with equation (4).

Our eclipse light curve is not suitable for solution because of the somewhat large scatter relative to the shallow eclipse depths. Nevertheless, we can conclude the following. From Figure 1 we see the eclipse duration from first to fourth contact is D = $0^{p}.08$ and it cannot be decided whether or not there is a constant phase at the bottom. From Figure 3 we see a primary minimum $0^{m}.085$ deep, a secondary minimum $0^{m}.05$ deep and not noticeably displaced, and some indication of an ellipticity effect. Although not included in Archive File No. 150, some B and U photometry was obtained at Braeside, Fairborn, and Lines Observatory. Linear regression analysis of this multibandpass photometry indicated that primary eclipse depths are in the ratio

$$\Delta V \,/\, \Delta B \,/\, \Delta U = 1.00 \,/\, \underset{\pm.05}{1.29} \,/\, \underset{\pm.07}{1.66}$$

and that secondary eclipse depths are in the ratio

$$\Delta V \,/\, \Delta B \,/\, \Delta U = 1.00 \,/\, \underset{\pm.06}{1.16} \,/\, \underset{\pm.10}{1.24} \;.$$

It may seem surprising that the depth increases at shorter wavelengths during both primary AND secondary eclipse. But this can be understood by realizing that the F7 V star and (probably) the unseen secondary in the eclipsing system are BOTH hotter than the G5 IV component of the triple system. It is consistent, we note, that the color becomes LESS blue during primary eclipse.

The results of our photometry in combination with all previously known information can best be understood in the following picture of the triple system HR 6469. The close pair consists of an F7 V primary and a not yet seen secondary which eclipse each other with an orbital period of $2^{d}.23$. The relative eclipse depths can provide an indication of the relative temperatures of those two stars. The G5 IV star orbits the close pair with an orbital period of 5.53 years and probably is responsible for the $83^{d}.2$ variability. This $83^{d}.2$ period probably is the rotation period of the G5 IV star, with the photometric variability and the weak H and K emission understandable within the context of starspot activity in chromospherically active stars.

Several of the above points need to be verified and a number of important questions need to be answered. The G5 IV star contributes how much light to the system? Is the F7 V star eclipsed at primary minimum? What will the light curve solution reveal about the unseen secondary star? Is the G5 IV star indeed responsible for the H and K emission? Is the variable G5 IV star a normal subgiant, is it an FK Comae-type variable, or might it be an SB1 with an orbital period of $83^{d}.2$?

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IMPROVED PERIOD FOR THE CATACLYSMIC VARIABLE V795 Her=PG 1711+336:
IS IT AN OUTSTANDING OBJECT?

Periodic light variations of the star PG 1711+336 were noticed by Mironov et al. (1983a, b). An identification chart, photoelectric magnitudes of 13 nearby stars and the position of the object in the (B-V, U-B) diagram were given in the first paper (1983a). The colour temperature of PG 1711+336=V795 Her was shown to be 20000°K. In the second paper (1983b) the position of the object in the (B-V, W-B) colour diagram was shown.

The photometry of V795 Her during the 1968-85 years has revealed long-term variability from $12^{m}.5$ to $13^{m}.2$ in B and short-periodic light variations with the amplitude $0^{m}.3$ and the period $P=0^{d}.11583$.

Monitoring of the variable was continued in 1984. Now we obtained 38 individual points in U, 75 in W, 213 in B, 116 in V and 59 in R (Julian Dates 2445442-2445959). Tables of observations will be given elsewhere.

An analysis of all observational points, obtained for V795 Her from 1983, allows us to improve the period of the optical light variations, which turns out to be two minutes shorter than given previously. The improved ephemeris is as follows:

$$\text{JD Min.hel.}=2445527.295+0^{d}.114488\cdot E$$

The light curve in B plotted with this ephemeris is shown in Figure 1.

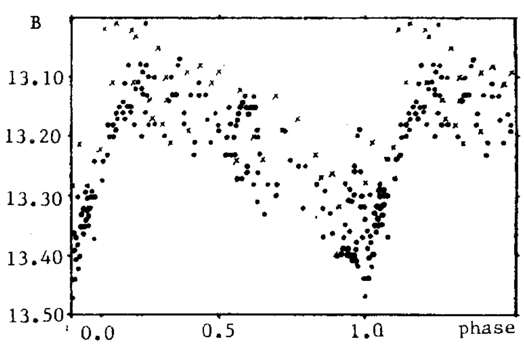

Figure 1: The B light curve of V795 Her. Notation: (.)-observations obtained with the 48 cm reflector at the Tian-Shan High-Altitude (3000m) Observatory of SSAI in Alma-Ata; (x)-observations obtained with the 60 cm Zeiss reflector at the SSAI Crimean laboratory (the altitude 600 m).

The minimum appears to be highly asymmetric ; egress is steeper than ingress. The out-of-eclipse magnitude, as well as a shape of the light curve, slightly change from cycle to cycle due to intrinsic variability. This leads to a significant scatter of the individual points in the light curve.Moreover, there are slight variations of (B-V) colour with the phase; near the maximum light, $B-V=-0\overset{m}{.}08$, and in a half-cycle, $B-V=-0\overset{m}{.}02$.

If the period determined is really the case, and not twice longer, then the variable falls into the gap in a histogram which describes distribution of cataclysmic variables vs. the period. If so, V795 Her can be a unique object. We recommend that more attention be paid to this star by observers, especially by spectroscopists. A radial-velocity curve for the star is highly needed in order to prove the value of the orbital period. A detailed investigation of physical parameters of V795 Her would help to interprete the nature of an observational "gap" in the distribution of cataclysmic variables.

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AK Her - NEW V LIGHT CURVE AND PERIOD CHANGE

Photoelectric observations of the W UMa - type eclipsing binary AK Herculis were carried out on three nights of May 16/17, May 17/18, June 29/30, 1983. The observations were made at Cracow Astronomical Observatory with the 50 cm reflector equipped with EMI 9789 QB photomultiplier. The Schott filter GG-11 in V region was used. The comparison star was BD+16^{o}3123 and BD+16^{o}3124 served as a check star. The comparison star was the same as used most often in previous investigations (Binnendijk, 1961; Woodward and Wilson, 1977; Bookmyer and Kaitchuck, 1979). Two hundred observations in V light in the sense of variable minus comparison are shown in Figure 1. A slight phase shift of secondaries to value 0.502 can be seen.

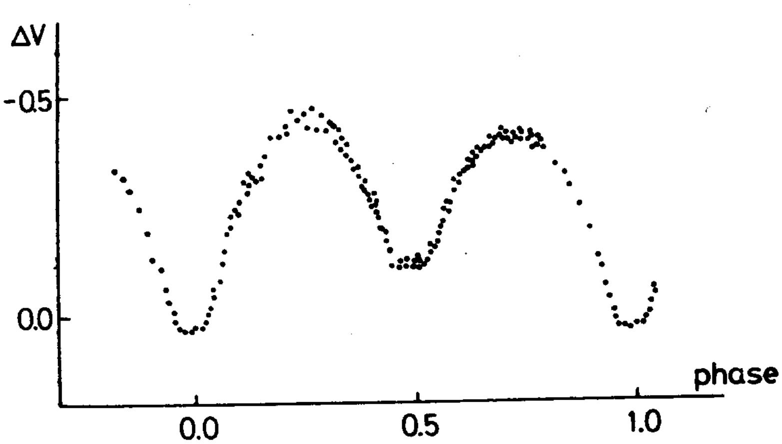

Figure 1

Times of minima obtained from these data with the Kwee and Van Voerden (1956) method are given in Table I.

Table I

J D Hel 244 0000+	O-C days	Min type
5471.38030 ± 18	+0.0139	I
5472.43500 ± 31	+0.0147	II
5515.43033 ± 32	+0.0148	II

The O-C values computed from the ephemeris published by Barker and Herczeg (1979)

$$J.D.Hel.Min.I = 242\ 3573.7060 + 0\overset{d}{.}42152227\ E$$

are plotted versus epoch in Figure 2. All points following J.D. 2433000 refer to photoelectric data.

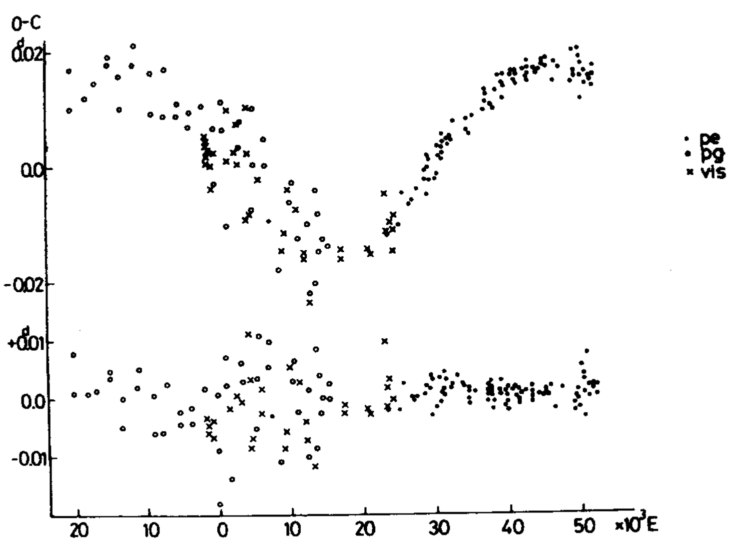

Figure 2

As the (O-C) diagram illustrates, a satisfactory light-time representation is possible as was suggested in the past (Herczeg and Schmidt, 1959; Rafert, 1982). A new period obtained for these data by a least squares fitting is equal to 65.95 years with an amplitude $0\overset{d}{.}0147$. The computed residuals from this sinusoid are shown in the lower part of Figure 2. The observations of AK Her covers only 80 years, so the problem of multiplicity of system is still open (Woodward and Wilson, 1977; Panchatsaram and Abhyankar, 1982).

From 29 photoelectric minima observed since 1976 we can find new linear elements :

$$\text{J.D. Hel.Min. I} = 244\ 2665.3091_{\pm 93} + 0^{d}.42152202_{\pm 19}\cdot E$$

The relative period change in the manner of sudden period changes is $\Delta P/P \sim -6.10^{-7}$.

The author would like to thank Dr.M. Winiarski for help during his stay in Cracow and the Astronomical Observatory for granting telescope time.

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PHOTOELECTRIC PHOTOMETRY OF EPSILON AURIGAE

Epsilon Aurigae was observed during the period 1982-1985 at the Jagiellonian University Observatory in Cracow (Fort Skała) and at the Station in the Bieszczady Mountains ($\lambda=-1^h29^m$, $\varphi=49^\circ10'$). These observations were made in coordination with the observational campaign of the star (Genet,Stencel 1982)

Two instruments in Cracow: the 500 mm Cassegrain reflector (hereafter denoted as R) and the 350 mm Maksutov reflector (denoted as M) as well as the 203 mm refractor (denoted as A) at the Mountain Station, equipped with one-channel photometers with UBV filters and photomultipliers: an EMI 9789 QB at the R-telescope and a Russian made FEU 92 at the others, were used in the presented observations. All these systems are close to the standard UBV system. The diaphragms used were: 24,40 and 122 arcsec, respectively.

The differential photometry of ε Aurigae in respect to λ Aurigae as comparison star were performed during 102 nights. The accepted magnitudes of the comparison star: $U=5\overset{m}{.}456$, $B=5\overset{m}{.}332$, $V=4\overset{m}{.}710$ are mean values of measurements from the Photometric Catalogue (Blanco et al. 1968). We attempted to make several measurements in each observational season, their actual number is given in column denoted N. However, for a number of reasons, it was not always possible. Due to this, our data are of unequal quality, so we decided to present them in different tables. When a number of individual measurements in B or V is greater than 5, observations are given in Table I, whereas for N<6 they are given in Table II. There are but a few observations in U-band, so they are listed in the separate Table III. Each measurement has been corrected for atmospheric extinction and the measurement means, reduced to the UBV system, are given in the respective column of each Table. The moments of observations, expressed in heliocentric MJD, are means of individual moments of measurements. The transformation formulae from instrumental ubv system to the UBV system are:

$$U_\lambda - U_\varepsilon = u_\lambda - u_\varepsilon + a_u\,((U-B)_\lambda - (U-B)_\varepsilon)$$
$$B_\lambda - B_\varepsilon = b_\lambda - b_\varepsilon + a_b\,((B-V)_\lambda - (B-V)_\varepsilon)$$
$$V_\lambda - V_\varepsilon = v_\lambda - v_\varepsilon + a_v\,((B-V)_\lambda - (B-V)_\varepsilon)$$

where the values of coefficients are :

instrument	a_u	a_b	a_v
R	+.0017 ±.0187	−.2846 ± .0100	−.1034 ± .0012
M		+.030 ±.012	−.146 ±.008
A		+.0143 ±.0025	−.1252 ±.0030

Atmospheric extinction was determined for each night. Sometimes, particularly when the differences of air masses for both stars were small throughout the observational season the mean coefficients were accepted ($C_V=0\overset{m}{.}4$ and $C_B=0\overset{m}{.}55$ for Cracow, $C_V=0\overset{m}{.}2$ and $C_B=0\overset{m}{.}35$ for the Mountain Station). In such cases in the column denoted ext we give admissible error in photometry, assuming fifty percent change in the accepted values of the extinction coefficient. In all cases this error did not exceed $0\overset{m}{.}005$. Measurements were recorded on paper tapes and due to small dynamics of the receiver its different ranges had to be used. These differences were determined for each night and the determination errors are also introduced into values presented in the column denoted SD. This does not apply to the R-telescope observations after MJD 45671.0, in which a digital receiver was used. The column denoted SD gives the standard deviation of measurements, together with mentioned above determination error, however it is meaningful only when the number of observations is sufficiently large.

The observed B and V light curves, along with colour index B-V, are presented in Figure 1. It can be seen from the light curves that in addition to the eclipsing variability ε Aurigae shows additional brightness changes. They are especially well discernible during totality. These changes are well above measurement errors and they have been reported also by other authors (see Hopkins and Stencel 1983). Their analysis will be published later. We have not been lucky enough to record supected flare activity of the star (Nha and Lee 1983). Our observations confirm the anomaly reported by Osi et al.(1984) and Boyd et al.(1984) near the third contact predicted by Gyldenkerne (1970). In both colours the rapid increase of brightness and its subsequent decrease can be observed. Moreover, near the fourth contact after the maximum we observed brightness decrease in both colours, as well as changes of B-V colour index.

As can be seen from Figure 1 the colour changes are very small. It seems that mean values of B-V index calculated separately for different phases are somewhat different, but these differences are small, slightly greater than 1σ level of significance. These means are denoted in Figure 1 by crosses.

The determination of time of contacts from our observations is difficult. Nevertheless, it seems that the second contact occurred a little earlier than predicted, whereas the third and the fourth contacts later than predicted.. Timing of minimum is difficult too, because light curve is asymmetric.

Table I : B, V photometry of Epsilon Aurigae

Date	MJD	B	SD	N	ext	MJD	V	SD	N	ext	inst	observer
Apr 5/6 1982	$45064^{\mathrm{d}}.821$	$3^{\mathrm{m}}.506$	$\pm^{\mathrm{m}}.005$	9	-	$45064^{\mathrm{d}}.804$	$2^{\mathrm{m}}.989$	$\pm^{\mathrm{m}}.004$	9	-	R	MW
Jul 29/30	180.067	3.706	.009	9	-	180.044	3.126	.005	11	-	R	MW
Oct 2/3	245.010	4.013	.016	6	-	245.040	3.473	.008	6	-	M	SZ
Oct 5/6	248.001	4.069	.012	7	.002	248.001	3.518	.006	6	.001	M	SZ
Oct 22/23	265.096	4.096	.003	11	-	265.071	3.547	.002	11	-	A	MW
Oct 22/23	265.095	4.081	.016	7	-	265.094	3.601	.006	7	-	M	SZ
Oct 29/30	272.091	4.105	.004	13	.002	272.051	3.572	.004	15	-	R	MW
Nov 6/7	280.062	4.159	.003	11	-	280.042	3.634	.002	11	-	R	MW
Nov 7/8	281.062	4.167	.006	10	-	281.041	3.642	.002	10	-	R	MW
Nov 11/12	285.054	4.188	.003	12	-	285.032	3.646	.003	11	-	R	MW
Nov 21/22	294.992	4.231	.020	10	-	294.992	3.696	.017	7	-	M	SZ
Nov 27/28	301.007	4.282	.003	10	-	300.990	3.737	.002	10	-	R	MW
Jan 12/13 83	346.870	4.289	.007	9	.001	346.869	3.728	.005	9	.001	M	SZ
Feb 24/25	389.845	4.349	.009	10	.002	389.846	3.794	.006	9	.002	M	SZ
Feb 25/26	390.875	4.364	.004	10	-	390.901	3.780	.004	11	-	M	MW
Mar 12/13	405.865	4.355	.005	10	-	405.842	3.798	.002	12	-	A	MW
Mar 13/14	406.771	4.351	.006	10	-	406.744	3.800	.006	9	-	A	MW
Mar 13/14	406.745	4.348	.008	8	.001	406.796	3.807	.009	9	.001	M	SZ
Apr 17/18	441.819	4.263	.005	12	-	441.790	3.708	.005	12	-	M	MW
Aug 19/20	566.024	4.329	.017	7	-	566.003	3.660	.012	7	-	M	SZ
Aug 22/23	569.000	4.214	.010	8	-						M	SZ
Aug 26/27	573.050	4.258	.012	8	-						M	SZ
Aug 30/31	577.003	4.292	.012	9	-	576.972	3.779	.004	9	-	M	SZ
Sep 2/3	579.972	4.306	.008	6	-	579.972	3.731	.030	6	-	M	SZ
Sep 8/9	585.986	4.312	.022	7	-	585.987	3.792	.007	9	-	M	SZ
Sep 15/16	593.015	4.377	.005	16	-	593.019	3.795	.005	16	-	M	SZ
Sep 27/28	604.956	4.342	.004	12	-	604.957	3.766	.004	11	-	M	SZ
Sep 29/30	607.111	4.327	.010	9	.002	607.112	3.768	.006	9	.001	M	SZ

Table I (cont.)

Date	MJD	B	SD	N	ext	MJD	V	SD	N	ext	inst	observer
Oct 1/2 1983	609^d.092	4^m.344	±^{m}.005	19	^{m}.002	609^d.091	3^m.767	±^{m}.004	19	^{m}.001	M	SZ
Oct 1/2	609.144	4.305	.004	12	-	609.120	3.769	.003	13	-	R	MW
Oct 5/6	613.129	4.324	.009	6	.001	613.128	3.740	.009	6	.001	M	SZ
Oct 18/19	626.154	4.331	.004	11	.001	626.125	3.758	.004	11	.001	M	SZ
Oct 27/28	635.068	4.315	.006	16	.001	635.068	3.754	.006	16	.001	M	SZ
Oct 27/28	635.107	4.287	.004	11	-	635.084	3.751	.003	11	-	R	MW
Nov 8/9	45647.086	4.296	.005	13	.001	45647.045	3.713	.003	12	.001	A	MW
Nov 9/10	648.040	4.302	.006	10	.001	648.040	3.719	.004	10	.001	M	SZ
Nov 11/12	650.052	4.302	.006	13	.001	650.052	3.708	.007	13	.001	M	SZ
Dec 2/3	670.977	4.338	.006	30	.001	670.978	3.714	.006	30	.001	M	SZ
Dec 3/4	672.033	4.330	.024	12	.001	671.986	3.757	.003	14	.001	R	MW
Dec 4/5	672.937	4.324	.006	13	.001	672.936	3.765	.006	13	.001	M	SZ
Dec 4/5						672.966	3.718	.022	6	.002	R	MW
Dec 5/6	673.998	4.370	.005	20	.001	674.035	3.748	.005	20	.001	M	SZ
Dec 11/12	679.992	4.344	.003	10	.001	679.966	3.753	.003	10	.001	A	MW
Dec 12/13	681.051	4.334	.006	18	.001	681.052	3.747	.007	18	.001	M	SZ
Dec 14/15	682.921	4.312	.008	8	.001	682.908	3.747	.008	8	.001	M	SZ
Dec 14/15	682.976	4.352	.002	10	-	682.950	3.759	.002	10	-	A	MW
Dec 15/16	683.980	4.339	.003	10	-	683.947	3.748	.001	10	.001	A	MW
Dec 29/30	697.895	4.323	.007	19	.001	697.895	3.749	.005	19	.001	M	SZ
Dec 29/30	697.962	4.294	.002	13	.001	697.920	3.746	.002	19	.001	R	MW
Jan 11/12 84	710.861	4.251	.005	15	.001	710.861	3.691	.006	15	.001	M	SZ
Jan 11/12	710.922	4.216	.006	12	.001	710.864	3.703	.002	13	.002	R	MW
Jan 12/13	711.883	4.265	.005	12	.001	711.882	3.701	.006	12	.001	M	SZ
Jan 12/13						711.882	3.699	.002	12	.001	R	MW
Jan 16/17	715.942	4.256	.006	8	.001	715.946	3.711	.008	8	.001	M	SZ
Jan 23/24	722.894	4.271	.009	7	.001	722.895	3.719	.007	7	.001	M	SZ
Feb 18/19						748.767	3.664	.003	16	.001	R	MW
Feb 29/Mar 1	759.755	4.227	.010	6	.001	759.756	3.599	.009	6	.001	M	SZ
Feb 29/Mar 1	759.793	4.190	.005	7	.001	759.756	3.603	.002	14	.001	R	MW
Mar 1/2	760.806	4.184	.003	15	-	760.772	3.592	.004	14	.001	R	MW
Mar 14/15						773.760	3.473	.001	6	.001	R	MW
Mar 19/20	778.862	3.985	.002	11	-	778.781	3.407	.004	14	-	R	MW

Table I (cont.)

Date	MJD	B	SD	N	ext	MJD	V	SD	N	ext	inst	observer
Mar 19/20 84	$778^{d}.827$	$3^{m}.981 \pm$	$^{m}.009$	16	-	$778^{d}.827$	$3^{m}.393 \pm$	$^{m}.006$	16	-	M	SZ
Mar 24/25	783.790	3.955	.008	7	-	783.791	3.339	.007	8	-	M	SZ
Mar 27/28	786.842	3.885	.010	7	-						M	SZ
Apr 3/4	793.832	3.832	.012	8	-	793.833	3.248	.012	8	-	M	SZ
Apr 14/15						804.802	3.175	.014	6	-	M	SZ
Apr 15/16	805.793	3.751	.008	6	-	805.806	3.202	.010	6	-	M	SZ
Apr 25/26	815.797	3.703	.010	7	-	815.818	3.131	.009	6	-	M	SZ
Jul 31/Aug 1						913.075	3.036	.004	10	-	R	MW
Aug 14/15	45927.060	3.626	.009	8	-	45927.060	3.124	.011	8	-	M	SZ
Aug 19/20	932.019	3.583	.008	8	-	932.018	3.057	.006	8	-	M	SZ
Aug 22/23	935.025	3.603	.007	6	-						M	SZ
Aug 24/25						937.091	3.058	.006	11	-	A	MW
Sep 13/14	957.076	3.660	.004	8	-	957.022	3.062	.002	8	-	A	SZ
Sep 24/25	967.991	3.638	.006	8	-	967.988	3.062	.005	10	-	M	SZ
Sep 30/Oct 1	974.067	3.631	.006	6	-	974.067	3.058	.005	6	-	M	SZ
Oct 18/19	991.999	3.518	.010	7	-	991.999	2.985	.009	7	-	M	SZ
Oct 18/19						992.098	3.000	.004	14	.002	R	MW
Oct 19/20	993.084	3.506	.002	12	.003	993.093	2.996	.001	12	.002	R	MW
Oct 30/31	46004.082	3.542	.004	12	-	46004.049	3.007	.006	12	-	A	MW
Nov 4/5	009.033	3.523	.007	7	-						M	SZ
Nov 4/5	009.070	3.518	.004	12	-	009.090	3.010	.006	12	-	R	MW
Nov 7/8	012.067	3.519	.004	12	-	012.047	3.009	.001	11	-	R	MW
Nov 12/13						017.032	3.021	.011	14	-	R	MW
Nov 14/15						019.037	3.034	.007	12	.001	R	MW
Nov 30/Dec 1	034.997	3.548	.006	13	.001	034.973	3.026	.003	12	.002	R	MW
Dec 2/3	036.977	3.527	.003	11	.002	037.004	3.003	.003	10	.001	R	MW
Jan 15/16 85	080.919	3.654	.004	11	-	080.887	3.083	.005	11	-	A	MW
Jan 16/17	081.856	3.661	.002	11	.001	081.832	3.084	.002	11	.001	A	MW
Jan 28/29	093.985	3.560	.007	7	-	093.944	3.036	.006	8	-	M	SZ

Table II : B, V photometry of Epsilon Aurigae

Date	MJD	B	SD	N	ext	MJD	V	SD	N	ext	inst	observer
Sep 11/12 82	$45223^{d}.994$	$3^{m}.709$	$\pm^{m}.038$	3	$^{m}.002$	$45223^{d}.995$	$3^{m}.148$	$\pm^{m}.021$	3	$^{m}.002$	M	SZ
Sep 12/13	225.011	3.876	.010	5	-	225.011	3.377	.016	5	-	M	SZ
Sep 15/16	228.012	3.842	.030	3	-	228.011	3.364	.011	3	-	M	SZ
Sep 17/18	230.053	3.843	.030	4	.002	230.064	3.347	.009	2	.001	M	SZ
Sep 29/30	241.995	4.005	.008	5	-	241.997	3.443	.007	5	-	M	SZ
Oct 21/22	263.997	4.085	.040	2	-	263.998	3.570	.016	2	-	M	SZ
Oct 27/28						270.036	3.538	.020	2	.004	R	MW
Oct 27/28	270.055	4.221	.045	2	.001	270.054	3.625	.007	2	.001	M	SZ
Mar 23/24 83	416.803	4.288	-	1	.002	416.802	3.755	-	1	.001	M	SZ
Aug 22/23						568.999	3.667	.014	5	-	M	SZ
Aug 26/27						573.093	3.710	.009	2	-	M	SZ
Oct 13/14	621.084	4.324	.011	5	.001	621.083	3.761	.008	5	.001	M	SZ
Oct 24/25	632.049	4.300	.012	3	.001	632.048	3.704	.012	2	.001	M	SZ
Dec 3/4	671.898	4.324	.015	3	.001	671.898	3.743	.014	3	.001	M	SZ
Jan 2/3 1984	701.924	4.300	.010	5	.001	701.924	3.725	.009	5	.001	M	SZ
Jan 8/9	707.942	4.267	.005	5	.001	707.943	3.707	.009	5	.001	M	SZ
Jan 12/13	711.899	4.235	.006	4	.001						R	MW
Feb 7/8	737.825	4.303	-	1	.001	737.833	3.715	.010	3	.001	M	SZ
Feb 13/14	743.754	4.293	.009	5	.001	743.754	3.698	.009	5	.001	M	SZ
Mar 1/2	760.874	4.139	.021	2	.002	760.874	3.498	.008	5	.002	M	SZ
Mar 14/15	773.820	4.132	-	1	-	773.816	3.452	.010	4	-	M	SZ
Mar 20/21						779.776	3.408	.021	4	.001	R	MW
Mar 21/22						780.768	3.386	.007	4	.005	R	MW
Mar 21/22						780.774	3.426	.048	2	.001	M	SZ
Mar 27/28						786.847	3.308	.012	4	-	M	SZ
Apr 14/15	804.808	3.743	.008	5	-						M	SZ
Jul 11/12						893.035	2.907	.017	2	-	M	SZ
Jul 31/Aug 1	913.018	3.475	.038	5	-	913.018	2.866	.037	4	-	M	SZ

Table II (cont.)

Date	MJD	B	SD	N	ext	MJD	V	SD	N	ext	inst	observer
Aug 27/28 84	$45940^{\mathrm{d}}.044$	$3^{\mathrm{m}}.571$	$\pm^{\mathrm{m}}.012$	5	-	$45940^{\mathrm{d}}.044$	$3^{\mathrm{m}}.036$	$\pm^{\mathrm{m}}.006$	5	-	M	SZ
Sep 2/3	945.917	3.596	.040	3	-	945.918	3.004	.030	2	-	M	SZ
Oct 1/2	975.014	3.671	.016	2	.003	975.014	3.140	.006	2	.002	M	SZ
Oct 20/21	993.943	3.519	.008	2	-	993.946	2.979	.011	2	-	M	SZ
Nov 4/5						46009.033	2.992	.006	5	-	M	SZ
Nov 14/15	46019.053	3.519	.005	3	-						R	MW
Aug 3/4	916.068	3.530	.038	5	-	916.062	3.037	.018	5	-	M	SZ
Aug 9/10	922.020	3.584	.007	4	-	922.020	3.113	.016	4	-	M	SZ
Aug 13/14	926.070	3.569	.006	4	-	926.071	3.045	.016	4	-	M	SZ
Aug 22/23						935.025	3.055	.013	5	-	M	SZ
Aug 23/24	936.022	3.622	.012	5	-	936.023	3.053	.011	5	-	M	SZ

Table III : U photometry of Epsilon Aurigae

Date	MJD	U	SD	N	inst	observer
Apr 5/6 1982	$45064^{\mathrm{d}}.837$	$3^{\mathrm{m}}.890$	$\pm^{\mathrm{m}}.005$	8	R	MW
Jul 29/30	180.078	4.128	.014	3	R	MW
Nov 6/7	280.082	4.616	.003	11	R	MW
Nov 7/8	281.082	4.629	.003	10	R	MW

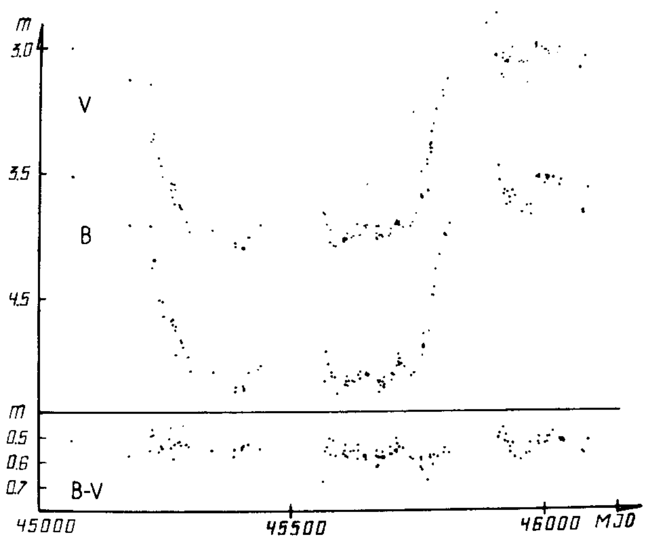

Figure 1 : B and V light curve of Epsilon Aurigae and B-V changes

Taking into account ingress and egress observations only, the classic tracing-paper method yields : minimum MJD hel. = $45510^d \pm 5^d$, fitting of Gaussian plus quadratic term gives : minimum MJD hel = $45512^d.2 \pm 0^d.1$ and fitting of straight lines (Gyldenkerne 1970) gives MJD hel=$45511^d.0$ as division value of the second-third contact segment in half.

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SEARCH FOR PECULIAR STARS IN THE REGION OF THE ASSOCIATION CASSIOPEIA OB 14

The search for peculiar stars can provide valuable information concerning their evolutionary status. Up to now this kind of work has been mostly restricted to accidental discoveries in different regions of the sky. The point is to look for indications of a possible preference of such special objects to certain stellar groups. In this respect, more observational data are desirable about the presence of these stars in star clusters and associations.

A program, initiated by us, of objective prism spectral classification in the regions of five OB-associations (in press), gave us the opportunity to reveal a great number of new peculiar or otherwise astrophysically interesting stars. A list of 90 stars, 73 of which - new-recognised as peculiar, in the region of the associations Cygnus OB 4, Cepheus-Lacerta OB 1 and Cassiopeia OB 9, has been published earlier (Radoslavova Ts., 1978, Astron.Tsirk., No.979, 5). The present list contains the results of an objective prism inspection for peculiar stars in a region of about 60 square degrees, centered at the association Cassiopeia OB 14.

The plates are taken with the 70 cm meniscus telescope of the Abastumani Astrophysical Observatory (USSR) using an 8^{o}-objective prism. The reciprocal dispersion at Hγ is 166 Å/mm and the spectra are widened to 0.4 mm. Each plate has a diameter of $4^{o}50'$, with high-quality images to the extreme edge. The exceptional seeing at Abastumani together with the purity of the spectra allows peculiar star discoveries with a great certainty (Kharadze E.K., Bartaya R.A., 1973, IAU Symp., 50, 91).

The Table lists the stars suspected in peculiarity, together with their positions (1950) and magnitudes given in the Bonner Durchmusterung. The stars sufficiently bright to be listed in the HD-catalogue are designated by their HD-numbers and magnitudes. There are several stars of about 9.5 to 10 photographic magnitude which are not present in the BD; for them the approximate coordinates are indicated, as calculated by us. In the last column the observed peculiarities in the spectra are noted; the semicolon indicates weak characteristics of the type.

Table I

HD or BD	R.A.	Decl.	m	Remarks and type
-	$00^h04^m.7$	$63^\circ49'$	-	Ap ;λ4128
-	00 09.4	59 47	-	Ap ;λλ4128, 4077
962	00 11.4	60 27	7.76	A+G comp.
+63°0020	00 13.8	64 08	9.5	Am
+65°0032	00 16.4	65 53	9.2	Ap ;λλ4128, 4077
+61°0045	00 18.2	62 30	9.4	Ap or Am ; 4128, 4070, 4030
-	00 20.4	62 24	-	Ap ; λ4128
2032	00 22.4	62 55	8.8	Am ; SAO 11176
+63°0044	00 22.9	63 33	9.4	Ap: ; λ4128
-	00 26.6	62 31	-	Ap ; λ4128
+64°0051	00 26.9	65 08	9.3	Ap: ; λ4128
+65°0065	00 28.0	65 52	9.2	Ap ; λ4128
+59°0081	00 32.4	60 11	9.3	Am or FOp
+61°0126	00 32.5	62 17	9.4	Am :
+62°0154	00 43.7	63 05	8.5	Am
+61°0180	00 51.5	61 37	9.3	Ap ; λ4128
+63°0109	00 51.8	64 16	9.3	Ap ;λλ4128, 4077
+65°1981	23 58.3	66 22	9.2	Ap ; λ4128

The low dispersion used did not permit us to give a more precise type of peculiarity; it is even possible some stars classified as Am to prove to be Ap, or vice versa. So, the interpretation of our discoveries is not straightforward. A higher resolution study of the objects in the list is obviously desirable, as well as information about their membership in the association, that should be acknowledged by the author.

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AUTOMATIC PHOTOELECTRIC TELESCOPE: SECOND AND THIRD QUARTER 1984 OBSERVATIONS

The automatic photoelectric telescope at Fairborn Observatory West in Phoenix, Arizona has been in operation since October 1983. Observations for the fourth quarter of 1983 were summarized by Boyd et al. (1984a) and are available as file no. 131 in the I.A.U. Commission 27 Archive for Unpublished Observations of Variable Stars (Breger 1982). Observations for the first quarter of 1984 were summarized by Boyd et al. (1984b) and are available as file no. 136 in the Archive mentioned above. In this brief note we summarize the observations from the second and third quarters of 1984, which are available as file no. 137 in the Archive. The second and third quarters were combined as a single file because shorter night time hours and poor weather limited the amount of data obtained in the second quarter and because an equipment malfunction ruined most of the data in the third quarter.

Table I lists the 83 groups in the program. The first column is the group number. The second is the group name. The last two give the number of observations obtained during each quarter. No data were obtained for four of the groups, which were below the horizon.

During the second quarter of 1984, 1430 group observations were made. Since each group observation consisted of a sequence of 33 different 10-second observations, there was a total of 47190 observations. During the third quarter there were 221 group observations and thus a total of 7293 individual observations. The sequence of UBV observations within a group, the extinction and transformation coefficients used in the reduction, and other particulars about the acquisition, reduction, and presentation of the data have been given already by Boyd et al. (1984a).

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References:

Breger, M., 1982, I.B.V.S. No.2246.
Boyd, L.J., Genet, R.M., and Hall, D.S., 1984a, I.B.V.S. No. 2511.
Boyd, L.J., Genet, R.M., and Hall, D.S., 1984b, I.B.V.S. No. 2561.

Table I

The 83 Groups on the Second and Third Quarter 1984 Observing Program

no.	name	2nd	3rd
1	lambda And	0	4
2	39 AY Cet	0	4
3	sigma Gem	29	2
4	V711 Tau	0	5
5	27 & 28 LMi	68	0
6	HR 9024	0	4
7	HR 7428	44	4
8	IM Peg	0	4
9	HR 7275	44	3
10	HR 6469	96	4
11	DK Dra	26	0
12	R Sct	50	3
13	12 BM Cam	3	2
14	33 Psc	0	4
15	5 Cet	0	4
16	UX Ari	0	3
17	59 d Ser	53	3
18	FS Com	66	0
19	HK Lac	15	4
20	AR Lac	13	4
21	29 Dra	6	0
22	54 Cam	37	2
23	51 & 52 Aur	15	2
24	CE Tau	4	2
25	TV Psc	0	4
26	RZ Ari	0	3
27	rho Per	0	3
28	IN Hya	25	0
29	epsilon Aur	3	2
30	zeta And	0	3
31	13 Cet	0	3
32	TZ CrB	46	2
33	omicron Dra	45	4
34	V350 Lac	8	4
35	93 Leo	77	0
36	II Peg	0	3
37	TZ Tri	0	4
38	53 xi UMa (B)	67	0
39	BH CVn	19	0
40	HD 26337	0	5
41	HD 8357	0	3
42	HR 454	0	5
43	HR 1362	0	5
44	HD 37824	4	4
45	HR 3337	21	0
46	HD 116204	57	0
47	theta CrB	62	1
48	iota Peg	23	3
49	HD 217188	0	4
50	HD 219989	0	4
51	beta Lyr	49	4
52	V367 Cyg	2	4
53	zeta Aur	2	2
54	31 Cyg	15	4
55	32 Cyg	24	4
56	HD 25893	0	3
57	HD 28591	0	2
58	HD 136901	63	0
59	HD 9312	0	3
60	HR 503	0	5
61	3 Cam	1	2
62	HR 1970	0	3
63	1 Gem	5	2
64	HR 4430	74	0
65	HR 6950	50	4
66	HR 7260	49	4
67	81 Psc	0	3
68	11 Hya	32	0
69	31 Com	22	0
70	37 Com	16	0
71	HR 1023	0	4
72	gamma Cas	0	4
73	HD 22403	0	3
74	HD 31738	0	3
75	HD 82558	0	0
76	HD 91816	0	0
77	HD 108078	0	0
78	HD 165590	0	3
79	HD 166181	0	4
80	HD 178450	0	4
81	HD 212280	0	0
82	HD 218153	0	5
83	HD 222317	0	6

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THE 67th NAME-LIST OF VARIABLE STARS

The fourth edition of the General Catalogue of Variable Stars (GCVS) now being prepared for publication contains data on 28457 variable stars finally designated by 1982 (including those named in the 62nd-66th Name-lists).

The present 67th Name-list of Variable Stars contains all data necessary for identification of 647 new variables finally designated in 1984. The total number of named variable stars has now reached 29104.

To facilitate for the investigators of variable stars the identification of objects of interest with the stars entering the name-list, we have changed the manner of name-list compilation taking into account the recommendations expressed by the IAU Commission 27 during the XVIII General Assembly of the IAU.

The 67th Name-list consists of two Tables. Table I contains the list of new variables arranged in the order of right ascensions. It gives the ordial number and the designation of a variable, its equatorial co-ordinates for the equinox 1950.0, the range of variability and the system of magnitudes used (sometimes the column "Min" gives in parentheses the amplitude of light variation), the type of variability according to the new system of classification described in the forewords to the 1st and the 2nd volumes of the 4th GCVS edition, as well as two references to the reference list which follows the Table II. The first reference indicates the investigation of the star, the second one indicates the paper containing a finding chart or the corresponding Durchmusterung (BD, CoD, or CPD) containing the variable.

Table II contains the list of variables arranged in the order of their names inside constellations. After the designation of a variable its ordial number in Table I is given, as well as all identifications needed for its finding in the papers with the first (or independent) announcement of the discovery of its variability. References to these papers are given in square brackets after the corresponding identification. The name of the discoverer in its original transcription accompanies the reference only in the case of its being different from the name of the author of the paper referred to.

We take an opportunity to correct one more mistake found in the 64th Name-list (I.B.V.S. No. 1581, 1978): instead KM Hya read KW Hya.

We are glad to express our deep gratitude to *T.D.Nishcheva* and *I.E.Kryukova* who prepared this Name-list for printing.

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Table I

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
001	V639	Cas	$00^h00^m51^s$	+63°21.'8	6.19	6.28	V	ACYG	108	BD
002	V640	Cas	00 03 38	+58 09.5	5.96	(0.066)	V	E:	109	BD
003	AP	Psc	00 05 38	−02 43.6	6.1	6.3	V	EB/GS	187	BD
004	V641	Cas	00 06 48	+63 40.5	10.1	11.1	P	SRB:	110	BD
005	V642	Cas	00 12 25	+63 34.3	10.3	11.3	P	ISB	112	111
006	CH	Tuc	00 16 15	−74 33.5	15.8	16.3	P	EA	348	347
007	LR	And	00 20 12	+29 10.6	6.9	(0.025)	V	ELL	001	BD
008	BD	Cet	00 20 14	−09 30.5	8.2	(0.10)	V	RS	226	BD
009	BE	Cet	00 20 18	−12 29.2	6.38	6.43	V	BY	239	BD
010	CI	Tuc	00 20 40	−73 54.1	15.6	16.5	P	RRAB	348	347
011	BF	Cet	00 24 30	+00 23.9	13.24	13.77	V	RRC	240	
012	V643	Cas	00 26 02	+60 06	11.7	12.1	P	DCEP	110	
013	BB	Phe	00 28 01	−41 13.0	6.18	(0.04)	V	DSCTC	183	CoD
014	LS	And	00 29 29	+41 41.6	11.7	20.2	B	NA	003	002
015	LT	And	00 32 49	+39 30.2	18.1	19.4	B	UG	004	005
016	BG	Cet	00 33 38	−23 07.0	6.35	(0.009)	B	DSCTC	245	CoD
017	LU	And	00 37 22	+42 49.0	17.3	(19.5	B	IA:	006	006
018	V644	Cas	00 58 15	+59 58.2	11.3	11.9	P	DCEP	020	
019	V645	Cas	01 15 44	+57 53.8	16.9	18.4	B	SRA	121	121
020	AQ	Psc	01 18 27	+07 20.7	8.60	8.96	V	EW/KW	188	BD
021	AR	Psc	01 20 20	+07 09.3	8.2	9.1	P	XI+RS	194	193
022	BC	Phe	01 20 21	−56 59.5	8.4:	(0.06)	V	RS	024	CoD
023	BG	Hyi	01 22 47	−70 56.2	8.2	(0.03)	V	DSCTC	476	CPD
024	AS	Psc	01 25 24	+30 59	16.5	(21.5	B	UG:	191	190
025	V646	Cas	01 27 13	+62 28.1	10.21	10.5	B	EA/KE:	124	124
026	BH	Hyi	01 28 40	−77 08.6	16.4	16.8	P	E	348	347
027	UV	Tri	01 29 15	+30 07.2	11.2	(0.07)	V	DSCTC	339	
028	BI	Hyi	01 35 24	−77 26.8	16.0	16.4	P	E	348	347
029	BK	Hyi	01 36 41	−79 12.3	16.0	16.7	P	RRAB	348	347
030	BL	Hyi	01 39 38	−68 08.5	14.9	(18	V	E+XPRM	480	479
031	BM	Hyi	01 42 52	−61 16.1	7.0	(0.04)	V	ACV	066	CPD
032	V357	Cep	01 58 46	+78 37	13.5	14.5	P	E+IS:	204	203
033	V472	Per	02 05 10	+58 11.2	5.64	5.74	V	ACYG	175	BD
034	V473	Per	02 13 09	+56 30.4	8.25	8.27	V	BCEP:	180	BD
035	LV	And	02 16 19	+41 32.2	14.8	16.2	P	RRAB	007	007
036	LW	And	02 16 34	+38 13.8	15.5	16.4	P	EA:	007	007
037	LX	And	02 16 39	+40 13.7	13.5	16.4	P	RVB	007	007
038	LY	And	02 18 48	+38 24.1	14.1	14.8	P	EW/KW	007	007
039	V474	Per	02 18 51	+55 37.1	5.15	5.25	V	ACYG	175	BD
040	LZ	And	02 19 32	+40 18.4	17.1	17.6	P	EW/KW	008	007
041	MM	And	02 19 33	+42 55.9	16.5	17.8	P	EA/SD	007	007
042	MN	And	02 19 43	+41 42.0	15.1	16.2	P	EB/SD	007	007
043	V358	Cep	02 20 43	+80 56.7	13.5	14.5	P	EB/KW	207	206
044	MO	And	02 20 47	+39 45.5	13.2	16.2	P	EA/SD	007	007
045	MP	And	02 21 06	+41 06.2	15.4	17.0	P	RRAB	007	007

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
046	MQ	And	$02^h21^m55^s$	$+43^\circ08'.6$	15.8	18.0:	P	*	007	007
047	MR	And	02 22 21	+40 44.0	15.5	16.1	P	RRC	007	007
048	MS	And	02 22 40	+39 45.3	15.8	16.5	P	EW/KW	007	007
049	V475	Per	02 23 10	+57 27.3	7.15	7.26	V	ACYG	175	BD
050	MT	And	02 23 58	+39 50.0	14.8	15.3	P	EW/KW	007	007
051	MU	And	02 26 20	+39 18.5	15.7	16.8	P	RRAB	007	007
052	V647	Cas	02 26 36	+62 18	14.8	17.2	B	SRA	126	126
053	MV	And	02 27 03	+40 39.8	16.0	16.7	P	RRAB	007	007
054	MW	And	02 28 21	+39 28.1	15.0	15.8	P	EW/KW	007	007
055	MX	And	02 28 52	+41 55.3	17.0	17.9	P	RRAB	007	007
056	MY	And	02 28 58	+42 51.6	15.4	16.3	P	RRAB	007	007
057	MZ	And	02 34 51	+43 05.4	15.2	15.7	P	EW/KW	007	007
058	V476	Per	02 36 07	+43 24.1	14.6	15.2	P	EW	007	007
059	V477	Per	02 40 34	+40 20.1	14.4	15.1:	P	EA	007	007
060	V478	Per	02 42 10	+39 33.1	16.6	17.4	P	EW/KW	007	007
061	UW	Tri	02 42 15	+33 18.8	14.6	(17.5	P	NA	343	
062	V479	Per	02 42 51	+43 04.5	14.4	17.9	P	EA:	007	007
063	V480	Per	02 45 48	+56 52.6	6.23	6.30	V	ACYG	175	BD
064	V648	Cas	02 47 19	+57 39.0	11.8	12.6	P	LC	118	BD
065	BN	Hyi	03 09 11	−79 10.8	5.7	(0.02)	V	DSCTC	481	CPD
066	BO	Cam	03 12 30	+62 54.7	14.7	15.3	P	E	038	037
067	BP	Cam	03 18 15	+61 25.4	15.3	16.8	P	UV:	038	037
068	BQ	Cam	03 31 15	+53 00.4	11.3	12.1	J	XFPNG	040	482
069	V810	Tau	03 40 04	+24 30.8	12.04	(0.075)	V	BY	312	312
070	V811	Tau	03 42 23	+23 34.4	12.66	(0.15)	V	BY	315	315
071	V812	Tau	03 43 06	+23 15.1	12.90	(0.125)	V	BY	315	315
072	V813	Tau	03 43 07	+24 24.8	12.81	(0.09)	V	BY	312	312
073	V814	Tau	03 43 41	+23 52.6	12.30	(0.075)	V	BY	312	312
074	V815	Tau	03 44 15	+23 33.7	12.41	12.52	V	BY	315	315
075	V816	Tau	03 48 54	+24 14.4	12.73	(0.125)	V	BY	315	315
076	V817	Tau	03 54 06	+23 01.9	6.06	(0.05)	V	ELL	318	BD
077	EI	Eri	04 07 15	−08 01.5	6.95	7.32	V	RS	435	BD
078	V481	Per	04 09 25	+49 34.7	12.0	13.2	P	EB:	182	181
079	V482	Per	04 12 05	+47 17.8	10.6	10.9	P	EA/DM:	182	181
080	V818	Tau	04 14 47	+16 49.6	8.30	(0.15)	V	E/RS	321	BD
081	TT	Ret	04 15 35	−61 04.3	6.37	(0.015)	V	ACV	064	CPD
082	V819	Tau	04 16 23	+28 19.5	13.14	13.50	V	BY	323	322
083	V820	Tau	04 19 48	+25 28	15.2	17.5	B	UV	324	
084	V821	Tau	04 21 30	+23 48	16.0	17.1	B	UV	324	
085	V822	Tau	04 22 42	+21 51	14.5	19.5	P	UV	324	
086	V823	Tau	04 23 18	+24 35	15.9	17.4	P	UV	324	
087	V824	Tau	04 25 12	+24 18	14.9	20	P	UV	324	
088	V825	Tau	04 28 12	+26 25	14.7	20	P	UV	324	
089	V826	Tau	04 29 21	+17 55.4	13.3	(0.5)	B	BY	322	322
090	V827	Tau	04 29 23	+18 13.9	14.15	14.74	U	UV+BY	329	322

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
091	V828	Tau	04^{h}29^{m}42^s	+22°36′	16.8	18.5	B	UV	324	
092	V829	Tau	04 29 48	+26 28	15.0	20.5	P	UV	324	
093	V830	Tau	04 30 11	+24 28.0	12.08	12.37	V	BY	323	322
094	V831	Tau	04 30 37	+23 35	16.4	17.6	P	DSCT	332	331
095	V832	Tau	04 31 48	+26 28	15.9	17.1	P	UV	324	
096	V833	Tau	04 33 42	+27 02.0	9.1	9.9	P	BY	335	BD
097	V834	Tau	04 38 22	+20 48.6	7.94	8.33	V	BY	337	BD
098	V835	Tau	04 40 54	+22 17	14.6	18.8	P	UV	324	
099	BR	Cam	04 55 21	+55 20.8	16.0	(0.3)	V	ZZ	041	042
100	YY	Men	04 59 51	−75 20.8	8.60	8.89	V	FKCOM:	422	CPD
101	V836	Tau	05 00 02	+25 18.6	13.02	13.24	V	BY	323	322
102	TU	Lep	05 04 05	−14 45.8	7.07	(0.105)	V	ACV	065	BD
103	V1085	Ori	05 09 07	+00 27.3	6.65	6.70	V	ACV	072	141
104	TT	Pic	05 15 12	−45 58.0	7.1	(0.07)	V	ACV	064	CoD
105	V361	Aur	05 17 25	+30 45.5	15.6	(0.02)	V	ZZA	028	029
106	TV	Lep	05 17 27	−25 46.6	15.9	17.4	B	RRAB	172	
107	BS	Cam	05 17 31	+69 21.2	8.0	(0.05)	V	DSCTC	044	BD
108	V1086	Ori	05 22 09	+01 48.1	4.92	4.96	V	GCAS	143	141
109	V1087	Ori	05 22 48	−04 37	13.5	17.6	U	UVN	144	
110	V362	Aur	05 23 58	+29 52.8	7.29	7.73	V	LC	030	BD
111	V1088	Ori	05 24 10	−05 46.9	15.2	17.0	P	UVN	145	145
112	V1089	Ori	05 24 45	−05 25.3	14.9	16.5	P	UVN	145	145
113	V1090	Ori	05 24 54	−07 04	13.4	18.4	U	UVN	144	
114	V1091	Ori	05 26 11	−06 05.6	15.5	16.7	P	UVN	146	146
115	V1092	Ori	05 28 08	−04 39.8	15.4	20.4	P	UVN	146	146
116	V1093	Ori	05 28 12	−00 24.6	8.20	(0.03)	V	ACV	072	141
117	V1094	Ori	05 28 14	−04 56.0	16.2	19.8	P	UVN	146	146
118	AB	Dor	05 28 36	−65 29.3	6.77	6.98	V	FKCOM:	395	CPD
119	V1095	Ori	05 29 18	−07 19.8	15.9	17.7	P	UVN	145	145
120	V1096	Ori	05 29 19	−07 38.4	15.0	19.4	P	UVN	145	145
121	V1097	Ori	05 29 30	−05 41	16.4	18	P	UVN	144	
122	V1098	Ori	05 29 35	−03 42.5	15.6	17.4	P	UVN	146	146
123	V1099	Ori	05 29 41	−01 38.1	8.29	(0.03)	V	SXARI	072	BD
124	V1100	Ori	05 29 44	−04 45.2	16.2	(21.0	P	UVN	146	146
125	V1101	Ori	05 29 46	−04 33.2	8.14	(0.06)	V	SXARI	072	148
126	V363	Aur	05 30 17	+36 58.0	14.43	15.5	B	E+NL	032	033
127	V1102	Ori	05 30 18	−04 30	14.0	17.5	U	UVN	149	
128	V1103	Ori	05 30 28	−05 15	16.0	18.5	U	UVN	150	
129	V1104	Ori	05 30 35	−04 12	14.6	15.8	U	UVN	151	
130	V1105	Ori	05 30 45	−05 57.0	16.3	19.2	P	UVN	146	146
131	V1106	Ori	05 30 48	−04 21	13.8	15.5	U	UVN	144	
132	V1107	Ori	05 30 52	+00 35.3	8.06	(0.02)	V	SXARI	072	BD
133	V1108	Ori	05 30 52	−07 03.9	14.8	16.5	P	UVN	146	146
134	V1109	Ori	05 31 03	−07 44.2	15.6	17.6	P	UVN	145	145
135	V1110	Ori	05 31 04	−06 06.1	15.1	16.7	P	UVN	146	146

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
136	V1111 Ori	$05^h31^m05^s$	−06°26.′2	16.4	18.6	P	UVN	146	146
137	V1112 Ori	05 31 07	−06 27.8	16.4	(21.0	P	UVN	145	145
138	V1113 Ori	05 31 12	−06 50.7	13.9	15.4	P	UVN	146	146
139	V1114 Ori	05 31 40	−05 13.7	14.5	15.5	P	UVN	145	145
140	V1115 Ori	05 31 41	−06 06.7	16.7	17.8	P	UVN	145	145
141	V1116 Ori	05 32 00	−05 34.4	13.5	17.8	U	UVN	149	148
142	V1117 Ori	05 32 10	−04 04.0	15.6	16.6	P	UVN	146	146
143	V1118 Ori	05 32 17	−05 35.6	12.6	(17.5	P	IN:	153	152
144	V1119 Ori	05 32 17	−07 38.1	15.2	16.4	P	UVN	146	146
145	V1120 Ori	05 32 33	−06 44.1	16.6	17.7	P	UVN	146	146
146	V1121 Ori	05 32 40	−04 28	15.2	17.7	U	UVN	151	
147	V1122 Ori	05 32 51	−06 07.0	15.1	16.9	P	UVN	146	146
148	V1123 Ori	05 32 56	−05 12.6	13.1	15.3	P	UVN	145	145
149	V1124 Ori	05 33 20	−05 15.2	15.5	17.0	B	UVN	146	146
150	V1125 Ori	05 33 20	−06 19	11.9	20.2	U	UVN	150	
151	V1126 Ori	05 33 20	−06 47.1	15.6	19.6	P	UVN	146	146
152	V1127 Ori	05 33 35	−05 09.4	14.5	15.5	P	UVN	145	145
153	V1128 Ori	05 33 37	−04 52.8	15.4	17.7	B	UVN	146	146
154	V1129 Ori	05 33 41	−05 22.8	14.3	17.4	P	UVN	145	145
155	V1130 Ori	05 33 44	−00 19.6	8.54	(0.03)	V	ACV	072	BD
156	V1131 Ori	05 33 46	−05 02	14.1	21	U	UVN	150	
157	V1132 Ori	05 33 57	−07 17.8	15.9	19.3	P	UVN	146	146
158	V1133 Ori	05 34 05	−06 29.0	8.11	(0.03)	V	ACV	072	141
159	V1134 Ori	05 34 10	−05 45.8	15.6	17.3	P	UVN	146	146
160	V1135 Ori	05 34 10	−06 16.1	15.2	19.0	P	UVN	146	146
161	V1136 Ori	05 34 22	−05 58.5	15.0	16.2	P	UVN	146	146
162	V1137 Ori	05 34 28	−06 21.5	14.1	18.6	P	UVN	146	146
163	V1138 Ori	05 34 48	−03 33.3	14.0	15.6	P	UVN	146	146
164	V1139 Ori	05 34 57	−06 05.1	14.3	15.8	P	UVN	146	146
165	V1140 Ori	05 35 06	−06 57.8	15.9	18.9	P	UVN	146	146
166	V1141 Ori	05 35 13	−06 54.5	16.5	(21.0	P	UVN	145	145
167	V1142 Ori	05 35 30	−06 26.4	14.0	15.0	U	UVN	151	148
168	V1143 Ori	05 35 35	−04 18.4	13	19	B	INT	160	161
169	V1144 Ori	05 35 40	−06 54.8	14.3	15.3	P	UVN	146	146
170	V1145 Ori	05 35 59	−07 34.8	14.4	17.9	P	UVN	145	145
171	V1146 Ori	05 36 08	−03 31.9	16.1	19.5	P	UVN	145	145
172	V1147 Ori	05 37 16	−02 42.2	9.01	(0.06)	V	ACV	072	141
173	V1148 Ori	05 37 26	−03 21.4	8.04	(0.04)	V	ACV	072	141
174	TW Lep	05 38 31	−20 19.4	7.0	(0.32)	V	RS:	401	BD
175	V1149 Ori	05 38 49	+03 45.2	7.2	(0.11)	V	RS:	163	BD
176	V1150 Ori	05 40 08	−06 47	15.8	19.2	U	UVN	150	
177	V1151 Ori	05 40 15	−04 50.4	16.1	19.8	P	UVN	145	145
178	V1152 Ori	05 41 08	−06 15.8	14.4	15.9	P	UVN	146	146
179	V1153 Ori	05 41 32	−05 59.4	15.0	16.3	P	UVN	145	145
180	TW Col	05 59 19	−42 52.2	7.0	(0.032)	V	ACV	064	CoD

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
181	V1154	Ori	$06^h05^m40^s$	+13°57!7	10.90	11.10	V	RRC	166	170
182	V1155	Ori	06 16 07	+17 20.8	6.32	(0.02)	V	ACV	131	BD
183	OU	Gem	06 23 14	+18 47.3	6.76	(0.05)	V	BY	436	BD
184	V648	Mon	06 25 34	+05 18.3	7.35	7.39	V	ACV	066	BD
185	V649	Mon	06 34 30	+06 06.2	7.56	7.62	V	ELL:	201	BD
186	V650	Mon	06 37 06	+10 15.4	15.2	15.83	B	IN	424	425
187	HM	CMa	06 43 06	−16 45.4	8.9	11.97	V	UV	056	056
188	V386	Car	07 03 22	−56 40.4	5.16	(0.026)	V	ACV	064	CPD
189	V651	Mon	07 06 50	−00 43.5	11.29	15.28	V	*	428	427
190	HN	CMa	07 10 23	−27 23.3	6.61	(0.025)	V	DSCTC	057	CoD
191	QW	Pup	07 11 08	−46 40.5	4.47	(0.027)	V	ACV	198	CoD
192	HO	CMa	07 11 17	−30 52.8	7.55	8.62	V	E:	058	CoD
193	V387	Car	07 12 32	−53 34.8	7.0	(0.023)	V	ACV	064	CPD
194	V388	Car	07 20 50	−55 40.5	7.94	(0.03)	V	ACV	066	CPD
195	V389	Car	07 21 05	−61 51.3	7.2	(0.01)	V	ACV	066	CPD
196	VX	Lyn	07 28 28	+39 14.2	16.7	17.7	P	RRAB	007	007
197	BG	CMi	07 28 44	+10 02.8	14.5	(0.43)	V	XBP	060	
198	VY	Lyn	07 29 03	+38 56.6	15.7	16.2	P	RRC	007	007
199	VZ	Lyn	07 29 12	+41 44.1	16.2	16.8	P	RRC	007	007
200	WW	Lyn	07 30 46	+38 17.3	11.6	12.1	P	EA/KE	007	007
201	WX	Lyn	07 32 14	+39 22.1	16.7	17.6	P	RRAB	007	007
202	WY	Lyn	07 35 14	+40 16.7	16.0	16.4	P	EW:/KW	007	007
203	WZ	Lyn	07 37 22	+39 25.8	13.9	15.1	P	RRAB	007	007
204	V390	Car	07 37 48	−53 09.5	6.06	(0.004)	V	ACV	067	CoD
205	XX	Lyn	07 39 02	+41 48.1	15.8	16.3	P	EW/KW	007	007
206	QX	Pup	07 39 59	−14 35.7	8.31	9.47	J	M	202	
207	XY	Lyn	07 40 11	+40 46.5	16.8	17.7	P	EA	007	007
208	XZ	Lyn	07 41 24	+40 20.0	16.2	16.9	P	RRC	007	007
209	YY	Lyn	07 42 10	+37 30.3	14.9	15.6	P	RRC	007	007
210	YZ	Lyn	07 42 15	+40 29.9	17.2	18.3	P	RRAB	007	007
211	QY	Pup	07 45 22	−15 52.0	6.24	6.71	P	SRD	098	BD
212	ZZ	Lyn	07 47 02	+37 49.6	15.2	16.6	P	RRAB	007	007
213	AA	Lyn	07 47 20	+41 41.7	14.7	15.3	P	EA	007	007
214	AB	Lyn	07 49 14	+41 38.0	16.1	16.6	P	EA	007	007
215	QZ	Pup	07 50 52	−38 43.9	4.47	4.54	V	ELL	209	CoD
216	AC	Lyn	07 51 21	+39 02.3	16.0	17.1	P	RRAB	007	007
217	AD	Lyn	07 53 00	+39 31.0	15.8	16.4	P	RRC	007	007
218	V335	Pup	07 54 48	−22 41.4	8.59	8.83	V	DCEPS	212	BD
219	V391	Car	07 57 13	−60 40.6	8.92	8.96	V	ACV	072	071
220	V392	Car	07 57 21	−60 43.7	9.49	9.67	V	EA/DM+ACV:	072	071
221	V393	Car	07 58 16	−61 26.8	7.47	(0.23)	V	DSCT	076	CPD
222	AE	Lyn	07 58 32	+57 24.9	6.49	(0.06)	V	RS	412	BD
223	V336	Pup	08 01 02	−41 10.1	5.52	(0.022)	V	ACV	064	CoD
224	V337	Pup	08 01 41	−29 16.6	7.6	(0.03)	V	ACV	066	CoD
225	IX	Vel	08 13 50	−49 04.0	9.1	10.0	P	NL	360	CoD

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
226	V394	Car	$08^h18^m09^s$	$-60°25'$	13.8	(17	P	M	077	
227	LM	Hya	08 23 57	−03 49.3	5.80	(0.006)	B	DSCTC	473	BD
228	DX	Cnc	08 26 52	+26 57.1	14.3	19.0	U	UV	049	050
229	DY	Cnc	08 31 37	+19 25.9	12.0	16.5	U	UV	051	
230	DZ	Cnc	08 31 39	+19 25.7	11.5	14	U	UV	051	
231	AF	Lyn	08 32 38	+41 11.6	15.9	16.9	P	RRAB	007	007
232	EE	Cnc	08 35 23	+19 38.7	11.0	14.5	U	UV	051	
233	AG	Lyn	08 35 39	+38 15.7	17.2	18.1	P	EW/KW	007	007
234	EF	Cnc	08 37 42	+23 26.8	11.7	12.4	P	EW	054	053
235	AH	Lyn	08 39 05	+37 21.9	13.5	14.3	P	EA	007	007
236	EG	Cnc	08 40 03	+28 02.4	11.9	17:	V	NL	055	055
237	AI	Lyn	08 40 47	+39 05.7	16.8	18.0	P	RRAB	007	007
238	AK	Lyn	08 42 40	+39 25.9	15.4	16.8	P	RRAB	007	007
239	AL	Lyn	08 45 59	+39 00.7	15.9	17.3	P	RRAB	007	007
240	AM	Lyn	08 46 39	+37 07.2	16.6	18.4	P	RRAB	007	007
241	IY	Vel	08 53 34	−44 51.0	6.23	6.27	V	*	362	CoD
242	IZ	Vel	08 59 29	−41 40.0	5.53	5.56	V	*	362	CoD
243	KK	Vel	09 05 54	−44 25.8	6.75	6.80	V	BCEP	365	366
244	KL	Vel	09 10 39	−43 24.4	5.56	5.57	V	ACV	368	CoD
245	AN	Lyn	09 11 13	+42 58.2	10.58	10.79	V	DSCT	413	BD
246	V395	Car	09 21 25	−63 04.8	15.50	18.6	B	XI+E:	080	078
247					omitted					
248	KM	Vel	09 39 24	−49 09	8.12	8.99	J	M	189	186
249	DL	Leo	09 40 21	+10 32.6	12.44	13.54	V	RRAB	451	450
250	DV	UMa	09 43 26	+45 00.6	14	19.8	B	UG	351	351
251	KN	Vel	09 45 54	−49 42.6	7.1	(0.09)	V	E	370	CoD
252	RZ	LMi	09 48 52	+34 21.6	14.4	16.8	B	NL	308	308
253	ST	Sex	09 49 42	+03 10.4	15.2	16.9	B	RRAB	172	
254	V396	Car	09 53 14	−57 29.4	8.32	(0.06)	V	ELL	081	CPD
255	SU	Sex	09 56 48	−04 45.0	15.8	16.8	B	RRAB	172	
256	V397	Car	09 58 47	−66 02.2	8.21	8.44	V	DCEPS	083	CPD
257	SV	Sex	09 59 02	−04 34.1	14.7	16.5	B	RR:	172	
258	DM	Leo	10 10 28	+11 21	12.5	(1.1V)	P	RRAB	453	063
259	SW	Sex	10 12 37	−02 53.6	14.8	16.7	B	E/WD+NL	307	308
260	KO	Vel	10 13 57	−47 43.2	17	(1.0)	V	NL+X	372	372
261	SX	Sex	10 14 18	+02 47.0	15.6	16.8	B	RRAB	172	
262	KP	Vel	10 14 42	−45 56.9	14.03	14.8	B	EA/SD	374	375
263	SY	Sex	10 23 18	+01 43	13.2	17.4	B	M	311	311
264	V398	Car	10 24 42	−58 23.2	9.69	(0.035)	V	E	084	CPD
265	V399	Car	10 25 32	−57 23.0	4.64	4.71	V	CEP	098	CPD
266	SS	LMi	10 31 19	+31 24	15.7	(20	B	NA:	460	460
267	V400	Car	10 32 54	−57 53.4	9.76	(0.01B)	V	BCEP	102	100
268	V401	Car	10 33 35	−57 56.5	9.56	(0.03B)	V	BCEP	102	100
269	V402	Car	10 33 38	−57 59.8	9.91	9.97:	V	GCAS	102	100
270	V403	Car	10 33 48	−57 57.2	8.78	(0.04B)	V	BCEP	102	100

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
271	V404	Car	$10^h33^m52^s$	$-57°58'.9$	9.21	9.23	V	BCEP	102	100
272	V405	Car	10 33 53	−57 57.1	9.29	(0.01B)	V	BCEP	102	100
273	V406	Car	10 34 03	−57 56.9	9.26	(0.03B)	V	BCEP	102	100
274	DN	Leo	10 36 17	+10 19.4	9.91	10.00	V	PVTEL:	455	BD
275	V407	Car	10 36 34	−64 46.9	6.71	6.74	V	ACV	104	CPD
276	DO	Leo	10 38 11	+15 27.3	16.0	17.0	B	NL	308	308
277	KQ	Vel	10 52 45	−41 59.0	6.10	6.12	V	ACV	198	CoD
278	V408	Car	10 56 17	−62 36.1	0.20	0.55	K	M	106	CPD
279	ST	LMi	11 02 58	+25 22.7	15.10	17.00	V	AM	462	463
280	DP	Leo	11 14 38	+18 14.1	17.5	19	V	XM	456	
281	V829	Cen	11 36 54	−39 06.4	7.9:	(0.11)	V	RS	024	CoD
282	DO	Dra	11 40 49	+71 58.0	10.0	15.1	B	UG	400	400
283	V830	Cen	11 45 02	−61 40.5	13.08	13.17	V	ELL+XP	164	165
284	DQ	Leo	11 45 24	+20 29.8	4.53	(0.03)	V	RS	458	BD
285	β	Leo	11 46 31	+14 51.1	2.14	(0.025)	V	DSCTC	459	BD
286	GQ	Mus	11 49 35	−66 55.6	7.2	(15	V	NB	430	431
287	GW	Vir	11 59 12	−03 28.5	14.87	(0.03)	V	ZZO	377	
288	BT	Cam	11 59 15	+80 21.7	16.0	(0.08)	V	ZZA	045	046
289	HX	Com	12 12 36	+14 40	15.2	16.5	B	RRAB	252	252
290	HY	Com	12 15 42	+16 25.8	10.25	10.73	V	RRC	254	BD
291	HZ	Com	12 27 08	+24 46.8	9.71	9.81	V	RS	255	BD
292	BU	Cam	12 34	+82 58	13.1	15.5	P	RRAB	048	048
293	II	Com	12 35 00	+14 42	15.0	16.2	P	RRAB	256	256
294	IK	Com	12 38 36	+15 12	15.0	16.1	P	RRAB	256	256
295	ρ	Vir	12 39 21	+10 30.7	4.88	(0.02)	V	DSCTC	385	BD
296	DP	Dra	12 47 04	+66 23.0	10.9	(1.55B)	V	UV	403	
297	LN	Hya	12 53 48	−26 11.4	6.57	6.90	V	SRD	098	CoD
298	GR	Mus	12 54 21	−69 01.1	18	19.1	V	XB	433	434
299	GX	Vir	13 02 56	−03 38.7	15.2	17.1	P	EA/SD:	172	
300	GY	Vir	13 08 44	−00 19.1	14.9:	16.7	P	RRAB	172	
301	V831	Cen	13 09 09	−59 39.3	4.49	4.66	V	ELL:	169	CPD
302	GZ	Vir	13 10 39	−02 17.5	8.0	(0.035)	V	DSCTC	378	BD
303	HH	Vir	13 11 05	−08 21.2	12.8	13.7	P	SR	379	379
304	HI	Vir	13 12 50	−07 24.0	14.5	15.7	P	RRAB	380	
305	HK	Vir	13 14 23	−08 43.2	14.4	15.6	P	RRAB	380	
306	HL	Vir	13 14 36	−02 55.1	13.7	15.2	P	RRAB	381	381
307	HM	Vir	13 14 48	−05 17.8	16.1	16.9	P	RRAB	172	
308	HN	Vir	13 20 39	−01 50.0	14.6	15.9	P	RRAB	379	379
309	HO	Vir	13 21 56	−04 59.4	15.5	16.3	P	RRAB	379	379
310	V832	Cen	13 22 51	−47 16.5	15.0	15.5	P	RRC	176	
311	V833	Cen	13 22 54	−47 22.1	14.4	15.4	P	RRAB	177	026
312	HP	Vir	13 30 15	−06 03.3	14.4	15.6	P	RRAB	380	
313	HQ	Vir	13 34 45	−01 34.6	14.6	16.2	P	SRA	379	379
314	HR	Vir	13 39 56	−03 23.6	14.4	15.1	P	RRAB	172	
315	HS	Vir	13 41 01	−07 59.0	13.0	15.8	B	NL	308	308

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
316	HT	Vir	$13^h43^m36^s$	+05°21.'9	7.06	7.48	V	EW/KW	383	BD
317	ν	Cen	13 46 30	−41 26.4	3.38	3.41	V	ELL:+BCEP	201	CoD
318	V834	Cen	14 05 58	−45 03.1	14.20	16.00	V	E+XPM	179	179
319	V835	Cen	14 10 23	−63 11.8	4.35	5.72	K	M	189	186
320	ι	Boo	14 14 24	+51 35.8	4.73	4.78	V	DSCTC	036	BD
321	α	Cir	14 38 26	−64 45.5	3.18	3.21	V	ACVO	251	CPD
322	BT	Cir	14 39 09	−61 59.7	7.4	(0.01)	V	DSCTC	247	CPD
323	BU	Cir	14 41 34	−55 23.5	6.10	(0.02)	V	BCEP	249	CPD
324	V836	Cen	14 43 19	−37 00.8	8.02	8.12	V	BCEP	197	CoD
325	CQ	Boo	14 51 45	+15 51	11.5	12.0	P	RRC	035	035
326	BV	Cir	14 56 50	−64 22.6	6.8	(0.10)	V	DSCT	250	CPD
327	HP	Lup	15 08 17	−36 03.6	9.27	9.52	V	EA	411	CoD
328	MQ	Ser	15 16 45	+01 57.2	4.99	5.11	V	BY:	295	BD
329	GW	Lib	15 16 58	−24 49.6	9.0	18.5	P	NA	402	
330	GX	Lib	15 20 46	−06 25.9	7.31	(0.08)	V	RS	404	BD
331	GY	Lib	15 21 49	−23 53.8	12.3	13.0	P	EB:	406	063
332	HQ	Lup	15 22 50	−39 42.8	7.37	7.38	V	ACV	248	CoD
333	LR	TrA	15 26 21	−65 25.8	7.73	7.92	V	DCEPS	346	CPD
334	GZ	Lib	15 26 45	−17 16.2	6.66	6.71	V	ACVO	408	BD
335	HH	Lib	15 30 16	−14 09.8	14.5	15.5	P	RR	409	
336	V335	Nor	15 30 38	−50 28.8	17.4	18.4	B	RRAB	432	432
337	V336	Nor	15 30 47	−50 40.8	18.0	18.9	B	RR:	432	432
338	V337	Nor	15 31 21	−50 43.2	18.0	18.5	B	E:	432	432
339	V338	Nor	15 31 29	−50 22.4	17.4	18.7:	B	RRAB	432	432
340	V339	Nor	15 31 35	−50 42.7	17.8	18.5	B	E:	432	432
341	MR	Ser	15 50 33	+19 05.3	15.0	17	V	AM	297	297
342	SS	UMi	15 51 18	+71 55.4	12.6	17.6	V	UG	355	355
343	V928	Sco	15 54 50	−23 23.0	6.74	6.76	V	ACV	248	CoD
344	MS	Ser	15 56 38	+25 42.8	8.20	8.31	V	BY	299	BD
345	V929	Sco	16 03 07	−23 28.3	5.89	5.91	P	SXARI	248	CoD
346	V930	Sco	16 06 48	−23 42	13.9	15.0	P	INS	089	090
347	V931	Sco	16 08 45	−25 31	13.6	(15.5	P	IN	089	090
348	V340	Nor	16 09 21	−54 06.5	8.26	8.60	V	DCEP	437	CPD
349	V341	Nor	16 09 51	−53 11.5	9.4	(12.4	V	NA	439	
350	V932	Sco	16 15 39	−28 38	12.3	(15.5	P	IN	089	090
351	V933	Sco	16 17 10	−19 56.2	7.37	(0.045)	V	ACV	072	BD
352	V934	Sco	16 18 21	−26 30	13.8	(15.5	P	IN	268	267
353	V935	Sco	16 19 30	−23 16	13.6	15.2	P	INS	089	279
354	V936	Sco	16 22 31	−29 17.2	7.63	7.71	V	ACV	065	CoD
355	DQ	Dra	16 23 19	+55 19.1	5.74	(0.017)	V	ACV	415	BD
356	V2128	Oph	16 23 30	−09 07.6	9.66	9.70	V	DSCTC	085	BD
357	V937	Sco	16 24 21	−24 47	14.5	(15.5	P	INS	089	088
358	V2129	Oph	16 24 39	−24 15.4	11.23	11.53	V	INT	086	087
359	V2130	Oph	16 25 32	−24 12.8	15.4	16.22	B	INSB	089	087
360	V938	Sco	16 27 06	−26 20	14.0	(15.5	P	INS	089	090

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
361	V2131 Oph	$16^h28^m15^s$	−24°30′	13.0	14.2	P	INS	089	090
362	V939 Sco	16 28 57	−25 25	13.6	14.8	P	INS	089	088
363	V940 Sco	16 29 03	−25 25	13.6	14.7	P	INS	089	088
364	V941 Sco	16 29 57	−25 31	13.6	14.6	P	INS	089	088
365	V942 Sco	16 30 33	−27 07	12.8	14.0	P	INS	089	279
366	V2132 Oph	16 31 00	−15 41	13.28	14.21	V	INT	091	091
367	V943 Sco	16 32 44	−25 01	13.5	15.0	P	INS	089	267
368	V944 Sco	16 32 47	−25 11.6	10.2	11.4	P	INS	089	267
369	V2133 Oph	16 33 44	−02 13.2	6.57	(0.04)	B	BY	092	BD
370	V823 Ara	16 39 40	−46 13.1	12.0	17	B	M	022	
371	V776 Her	16 45 19	+05 20.1	5.21	5.27	V	ACV	134	BD
372	V777 Her	16 45 25	+32 33.7	13.54	(0.30)	B	ZZB	445	446
373	V778 Her	16 48 22	+42 46	15.8	16.4	P	RRAB	447	447
374	V779 Her	16 49 54	+44 58	15.4	16.6	P	RRAB	447	447
375	V945 Sco	16 50 24	−41 47.4	9.83	(0.02)	B	BCEP	281	282
376	V946 Sco	16 50 31	−41 46.3	10.45	(0.06)	B	BCEP	281	282
377	V947 Sco	16 51 05	−41 48.8	10.16	(0.04)	B	BCEP	281	282
378	V780 Her	16 52 02	+49 19	14.9	15.9	P	RRAB	447	447
379	V781 Her	16 52 27	+47 02	13.6	16.7	P	UV	447	447
380	V782 Her	16 57 28	+43 35	14.1	17.0	P	M	447	447
381	V783 Her	16 57 31	+43 00	14.2	15.7	P	RRAB	447	447
382	V2134 Oph	16 58 55	−29 52.4	18.3	(23	V	XBND	093	115
383	V2135 Oph	16 59 09	−26 08	14.3	14.8	B	RRC	114	113
384	V784 Her	17 00 39	+43 35	15.3	16.6	P	RRAB	447	447
385	V785 Her	17 00 41	+48 31	15.3	16.7	P	RRAB	447	447
386	V948 Sco	17 00 51	−37 59.0	9.34	9.36	V	ACV	248	CoD
387	V786 Her	17 00 52	+46 01	14.7	16.2	P	RRAB	447	447
388	V787 Her	17 01 13	+49 04	16.4	17.2	P	RRAB	447	447
389	V788 Her	17 04 07	+42 54	16.3	17.0	P	RRAB	447	447
390	V789 Her	17 04 09	+42 35	14.9	15.6	P	EW/KW	447	447
391	V2136 Oph	17 07 34	−26 23.5	16.0	16.9	B	RRC	117	117
392	V790 Her	17 08 18	+46 24	15.7	16.8	P	RRAB	447	447
393	V791 Her	17 08 58	+46 53	15.6	16.5	P	RRAB	447	447
394	V792 Her	17 09 07	+49 01.6	8.5	(0.33)	V	EA/GS/RS	449	BD
395	V793 Her	17 09 12	+47 40	15.7	16.6	P	RRAB	447	447
396	V2137 Oph	17 09 13	−26 30.0	16.2	17.7	B	CEP	117	117
397	V2138 Oph	17 09 30	−29 12.2	16.0	20.8	B	M:	120	120
398	V2139 Oph	17 09 32	−29 25.9	17.3	19.6	B	SR:	120	120
399	V2140 Oph	17 09 33	−29 06.1	16.5	18.0	B	SR:	120	120
400	V2141 Oph	17 09 33	−29 33.9	17.1	19.3	B	RRAB	120	120
401	V2142 Oph	17 09 40	−28 57.8	18.1	19.8	B	RRAB	120	120
402	V2143 Oph	17 09 41	−29 19.7	16.2	18.0	B	SR:	120	120
403	V2144 Oph	17 09 46	−29 09.4	17.3	20.2	B	M:	120	120
404	V794 Her	17 09 50	+44 57	15.1	16.1	P	RRAB	447	447
405	V2145 Oph	17 09 54	−26 31.6	16.0:	(18.0	B	M	117	117

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
406	V2146 Oph	$17^h10^m01^s$	$-29°06.1$	17.6	19.4	B	SR:	120	120
407	V2147 Oph	17 10 04	−29 40.6	17.6	20.9	B	M:	120	120
408	V2148 Oph	17 10 10	−28 59.1	17.4	18.5	B	SR:	120	120
409	V2149 Oph	17 10 11	−29 05.8	17.1	18.8	B	RRAB	120	120
410	V2150 Oph	17 10 15	−29 37.4	17.1	19.2	B	RRAB	120	120
411	V2151 Oph	17 10 15	−29 41.1	17.1	19.7	B	RRAB	120	120
412	V2152 Oph	17 10 18	−29 09.2	16.0	18.3	B	SR:	120	120
413	V2153 Oph	17 10 35	−29 05.8	17.3	20.4	B	M:	120	120
414	V2154 Oph	17 10 35	−29 38.8	17.0	18.7	B	RRAB	120	120
415	V2155 Oph	17 10 41	−29 27.2	16.6	18.4	B	RRAB	120	120
416	V2156 Oph	17 10 42	−29 05.2	17.2	18.5	B	RRAB	120	120
417	V2157 Oph	17 10 42	−29 07.8	16.5	18.3	B	RRAB	120	120
418	V2158 Oph	17 10 47	−29 43.8	18.4	20.3	B	RRAB	120	120
419	V2159 Oph	17 11 00	−29 32.0	17.2	18.2	B	SR:	120	120
420	V795 Her	17 11 06	+33 34.8	12.5	13.2	B	NL	457	457
421	V2160 Oph	17 11 09	−29 16.0	17.2	20.3	B	M:	120	120
422	V2161 Oph	17 11 09	−29 20.3	16.3	17.6	B	RRAB	120	120
423	V2162 Oph	17 11 10	−29 46.1	17.6	19.8	B	RRAB	120	120
424	V2163 Oph	17 11 12	−29 33.4	15.8	17.0	B	SR:	120	120
425	V2164 Oph	17 11 15	−29 45	17.1	18.7	B	RRAB	120	120
426	V796 Her	17 11 16	+48 53	15.8	16.9	P	RRAB	447	447
427	V2165 Oph	17 11 16	−29 07.3	17.4	19.2	B	RRAB	120	120
428	V2166 Oph	17 11 20	−29 28.0	17.5	18.7	B	RRAB	120	120
429	V2167 Oph	17 11 27	−29 25.0	16.8	18.7	B	RRAB	120	120
430	V2168 Oph	17 11 28	−29 48.2	17.9	19.7	B	RRAB	120	120
431	V2169 Oph	17 11 31	−29 22.3	16.3	19.9	B	M:	120	120
432	V2170 Oph	17 11 31	−29 39.2	17.8	18.8	B	RRC	120	120
433	V2171 Oph	17 11 33	−29 22.1	17.0	18.1	B	RR	120	120
434	V2172 Oph	17 11 34	−28 59.5	18.8	21.5	B	M:	120	120
435	V2173 Oph	17 11 36	−29 23.2	17.1	17.8	B	RRC	120	120
436	V2174 Oph	17 11 39	−29 27.8	16.5	17.9	B	RRAB	120	120
437	V2175 Oph	17 11 42	−29 00.2	17.2	18.5	B	SR:	120	120
438	V2176 Oph	17 11 47	−29 09.5	17.2	18.5	B	SR:	120	120
439	V2177 Oph	17 11 52	−29 22.3	16.9	18.4	B	RRAB	120	120
440	V2178 Oph	17 11 53	−28 55.9	17.5	19.8	B	RRAB	120	120
441	V2179 Oph	17 11 56	−29 00.0	18.3	19.9	B	RR	120	120
442	V2180 Oph	17 11 59	−29 24.3	16.4	21.1	B	M:	120	120
443	V2181 Oph	17 12 01	−29 19.3	17.2	18.6	B	RRC	120	120
444	V2182 Oph	17 12 06	−29 09.2	17.9	19.9	B	RRAB	120	120
445	V2183 Oph	17 12 10	−29 26.1	16.0	21.4	B	M:	120	120
446	V2184 Oph	17 12 14	−29 42.2	17.0	19.0	B	RRAB	120	120
447	V824 Ara	17 12 18	−66 53.7	6.67	6.84	V	RS	024	CPD
448	V2185 Oph	17 12 19	−29 27.8	17.2	20.6	B	M:	120	120
449	V2186 Oph	17 12 25	−29 13.6	18.0	20.8	B	M:	120	120
450	V2187 Oph	17 12 29	−29 27.2	17.7	19.3	B	RRAB	120	120

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
451	V2188 Oph	$17^h12^m33^s$	$-29°32'.9$	17.7	19.1	B	SR:	120	120
452	V2189 Oph	17 12 38	−28 54.3	18.4	20.1	B	RRAB	120	120
453	V2190 Oph	17 12 39	−29 13.9	17.4	19.4	B	RRAB	120	120
454	V2191 Oph	17 12 40	−29 38.1	17.8	18.9	B	RRAB	120	120
455	V2192 Oph	17 12 41	−29 24.4	18.0	19.9	B	RRAB	120	120
456	V2193 Oph	17 12 53	−29 41.3	17.2	18.9	B	RRAB	120	120
457	V2194 Oph	17 12 54	−29 37.2	19.2	20.8	B	RRAB	120	120
458	V2195 Oph	17 12 58	−29 10.6	17.9	20.4	B	RRAB	120	120
459	V2196 Oph	17 13 02	−29 35.7	18.3	19.9	B	RRAB	120	120
460	V2197 Oph	17 13 03	−29 22.0	17.5	19.3	B	RR	120	120
461	V2198 Oph	17 13 05	−29 10.0	17.9	20.0	B	RRAB	120	120
462	V2199 Oph	17 13 12	−29 08.4	18.0	19.8	B	RR	120	120
463	V2200 Oph	17 13 19	−29 42.7	18.2	20.1	B	RRAB	120	120
464	V797 Her	17 14 49	+48 21	14.5	15.4	P	RR	447	447
465	V798 Her	17 15 05	+43 15.6	14.5	14.9	P	EW/KW	464	
466	V799 Her	17 16 49	+14 48	13	14	P	SRA	465	181
467	V800 Her	17 17 21	+42 32	15.2	15.7	P	RRAB	447	447
468	V801 Her	17 18 04	+13 33.9	15	15.5	P	SR	465	181
469	V802 Her	17 19 31	+44 29	15.8	16.9	P	RRAB	447	447
470	V803 Her	17 20 00	+44 42	16.0	17.1	P	EA/SD	447	447
471	V804 Her	17 20 24	+45 23	15.9	16.8	P	RRAB	447	447
472	V805 Her	17 20 40	+45 04	15.8	16.7	P	RRAB	447	447
473	V806 Her	17 21 38	+41 30	15.6	16.4	P	RRC	447	447
474	V807 Her	17 21 42	+41 54	14.2	16.1	P	EA/SD	447	447
475	V808 Her	17 22 48	+45 27	15.2	16.6	P	RRAB	447	447
476	V809 Her	17 26 07	+45 32	15.3	17.2	P	UG	447	447
477	MT Ser	17 26 10	−15 10.8	15.60	15.90	B	ELL/PN	303	303
478	V810 Her	17 28 39	+46 37	16.0	16.9	P	RRAB	447	447
479	V949 Sco	17 29 06	−34 14.6	6.13	(0.05)	V	DSCTC	284	CoD
480	V811 Her	17 29 33	+43 28	14.0	15.4	P	EA/SD:	447	447
481	V812 Her	17 33 00	+45 51	15.3	16.4	P	RR	447	447
482	V813 Her	17 33 32	+46 42	14.9	16.4	P	RRAB	447	447
483	DR Dra	17 34 03	+74 15.6	6.55	(0.12)	V	RS	419	BD
484	V950 Sco	17 34 07	−40 47.1	7.07	7.40	V	DCEPS	287	CoD
485	V825 Ara	17 36 05	−53 45.7	13.4	15.0	P	RV:	025	025
486	V826 Ara	17 36 12	−53 39.2	15.2	16.6	P	RR	025	025
487	V827 Ara	17 37 55	−53 46.6	15.9	16.9	P	RR:	025	025
488	V2201 Oph	17 41 32	+03 46.2	14.5	14.8	B	EW/KW	130	063
489	V2202 Oph	17 42 36	+05 49.3	15.0	16.0	P	RR	129	
490	V814 Her	17 43 41	+50 03.8	6.97	7.12	V	SRD	468	BD
491	V2203 Oph	17 47 12	+04 29.4	11.6	12.0	B	EW/KW	133	133
492	V951 Sco	17 50 38	−34 49.3	6.39	6.44	V	ACV	072	CoD
493	MU Ser	17 53 03	−14 00.9	7.7	(20	V	NA	304	305
494	V4070 Sgr	17 55 00	−29 01.1				M	225	225
495	V4071 Sgr	17 55 12	−28 49.3	6.47		K	M	225	225

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
496	V4072 Sgr	$17^h58^m26^s$	$-32°42'.9$	8.74	(1.2)	V	ELL/WR+*	228	CoD
497	V4073 Sgr	18 05 22	−22 57.0	13.6	(15.5	P	ZAND:	230	230
498	V815 Her	18 06 20	+29 41.0	7.6	(0.1)	V	RS	469	BD
499	V4074 Sgr	18 12 52	−30 52.3	8.6	12.3	P	ZAND	231	
500	V4075 Sgr	18 17 35	−29 53.0	13.8	(16.0	P	M	232	232
501	DS Dra	18 21 35	+64 20.5	15.04	(0.02)	V	ZZO	421	186
502	V433 Sct	18 22 15	−14 40.7	8.18	(0.055)	V	ACYG	291	BD
503	V2204 Oph	18 23 42	+11 53.3	13.7	(16.8	B	ZAND:	136	136
504	V434 Sct	18 25 27	−11 18.3	6.3	8.7	K	M	012	
505	V435 Sct	18 26 40	−12 39.7	4.7	7.2	L	M	012	
506	V436 Sct	18 27 24	−07 39.1	6.7	9.1	K	M	012	
507	V4076 Sgr	18 28 33	−26 40.8	13.0	(15.2	P	M	233	233
508	MV Ser	18 29 37	+03 37.3	6.13	(0.03)	U	ACV	134	BD
509	V4077 Sgr	18 31 33	−26 28.4	8.0	(20	V	N	237	236
510	V4078 Sgr	18 33 36	−25 27.2	14.6	(16.0	P	M:	233	233
511	V437 Sct	18 34 53	−05 26.8	6.9	10.8	K	M	012	
512	V479 Lyr	18 35 44	+42 46.2	15.4	16.5	P	LB	417	416
513	V438 Sct	18 38 33	−06 17.9	8.3	11.5	K	M	012	
514	V480 Lyr	18 38 52	+43 53.4	13.0	15.3	P	EB:	417	416
515	V4079 Sgr	18 39 11	−31 59.7	15.6	17.7	B	E:	238	238
516	V4080 Sgr	18 39 30	−32 40.7	16.2	17.2	B	RR	238	238
517	V4081 Sgr	18 39 46	−32 28.4	17.3	(18.3	B	RRAB	238	238
518	V4082 Sgr	18 39 52	−32 29.9	15.1	15.6	B	RRC	238	238
519	V4083 Sgr	18 39 58	−32 45.5	14.9	16.5	B	RRAB	238	238
520	V4084 Sgr	18 40 14	−32 02.6	16.5	(18.0	B	RRAB	238	238
521	V4085 Sgr	18 40 18	−32 48.3	16.0	16.9	B	RR	238	238
522	V4086 Sgr	18 40 25	−31 58.5	15.3	16.8	B	RRAB	238	238
523	V816 Her	18 40 27	+13 51.0	13.6	14.6	P	UV	471	470
524	V4087 Sgr	18 40 48	−32 03.2	15.8	17.2	B	RRAB	238	238
525	V439 Sct	18 43 10	−04 04.0	7.2	9.4	H	M	012	
526	V1360 Aql	18 43 17	−01 50.0	10.4	12.5	K	M	012	
527	V440 Sct	18 43 45	−06 43.8	9.4	12.0	H	M	012	
528	V1361 Aql	18 44 33	−02 39.0	8.5	12.2	H	M	012	
529	V1362 Aql	18 46 04	−02 53.8	5.3	6.5	L	M	012	
530	V481 Lyr	18 46 14	+43 40.2	12.8	14.3	P	E	420	420
531	V4088 Sgr	18 48 09	−20 21.6	7.49	7.87	V	E	241	BD
532	DT Dra	18 48 51	+50 32	13.3	14.7	P	RRAB	426	423
533	V1363 Aql	18 48 52	−01 07.1	5.8	6.7	L	M	013	
534	V1364 Aql	18 49 26	−01 30.2	6.5	8.0	H	M	012	
535	V1365 Aql	18 49 48	−00 17.9	3.9	7.2	L	M	012	
536	V1366 Aql	18 56 04	+06 38.8	7.5	9.3	H	M	013	
537	V1367 Aql	19 01 43	+06 09.0	9.0	11.4	K	M	012	
538	V482 Lyr	19 05 58	+43 11.9	13.8	14.7	P	E:	417	416
539	V1368 Aql	19 06 44	+08 11.9	6.8	7.9	L	M	012	
540	V1762 Cyg	19 07 15	+52 20.7	5.81	6.03	V	RS	258	BD

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
541	QR Sge	$19^h09^m16^s$	+16°46.'6	11.04	11.12	V	E:/WR	216	
542	V1369 Aql	19 11 59	+11 05.4	6.7	9.0	K	M	012	
543	V1370 Aql	19 20 50	+02 23.6	6.0:	20.0:	V	NA	016	016
544	PW Vul	19 24 03	+27 15.9	6.43	17:	V	N	387	388
545	PX Vul	19 24 34	+23 48.0	11.56	11.82	V	INB	390	390
546	V1763 Cyg	19 29 54	+38 56	12.4	13.0	B	EW/KW	260	259
547	V4089 Sgr	19 30 43	−40 08.6	5.87	6.07	V	EA/DM	244	CoD
548	QS Sge	19 32 54	+18 15.8	13.2	13.8	P	I	218	217
549	V1764 Cyg	19 34 41	+27 46.3	7.69	(0.15)	V	RS	261	BD
550	V1371 Aql	19 34 57	+09 13	15.5	16	P	RRAB	018	017
551	PY Vul	19 35 11	+27 36.5	13.0	(<0.02)	V	ZZA	041	391
552	V1372 Aql	19 36 05	+08 18	15.5	16	P	RR	018	017
553	QQ Tel	19 36 07	−45 23.6	6.53	(0.050)	B	DSCTC	245	CoD
554	V4090 Sgr	19 36 32	−39 32.9	6.58	6.81	V	EA/DM	244	CoD
555	V1373 Aql	19 36 54	+13 31	16.5	17.5	P	E	018	017
556	V1374 Aql	19 38 59	+08 12	14.5	15	P	LB	018	017
557	V1375 Aql	19 39 07	+13 07	15.5	16.5	P	LB	018	017
558	PZ Vul	19 42 01	+22 50.3	17.6	18.7	R	M:	392	392
559	ST UMi	19 45 36	+88 40.0	14.0	15.8	P	RRAB	356	356
560	QT Sge	19 46 20	+18 04	10.50	(0.04)	V	E:/WR	219	220
561	V1765 Cyg	19 46 56	+33 18.7	6.44	(0.16)	V	EB/GS+ACYG	263	BD
562	V1766 Cyg	19 49 43	+43 30.0	10.3	11.5	V	SRA	269	269
563	V1767 Cyg	19 50 00	+44 06.7	11.0	12.5	V	SRA:	269	269
564	QU Sge	19 51 35	+18 37.7	15.2	17.0	P	E	221	221
565	V1376 Aql	19 55 28	+11 26.1	11.6	12.7	P	EA/GS	020	019
566	V1768 Cyg	20 02 38	+32 04.5	5.56	5.70	V	ACYG	271	BD
567	V4091 Sgr	20 03 09	−18 50.9	8.4	(0.04)	V	RS:	246	BD
568	QQ Vul	20 03 30	+22 31.5	14.4	17.0	B	XM	394	394
569	V1769 Cyg	20 08 22	+36 01.7	7.99	8.09	V	EA/D/WR	274	BD
570	V1770 Cyg	20 10 17	+38 12.2	7.48	7.52	V	E:/WR	275	BD
571	QR Vul	20 13 09	+25 26.3	4.60	4.80	V	GCAS	396	BD
572	QS Vul	20 13 20	+23 21.3	5.15	(0.12)	V	EA/GS	397	BD
573	V1771 Cyg	20 15 06	+42 49.1	14.1	15.8	V	EA/SD:	277	276
574	V1772 Cyg	20 15 30	+42 28.0	17.0	19.6	U	UV	278	
575	V1773 Cyg	20 17 13	+46 09.9	6.44	(0.05)	V	ELL	283	BD
576	QV Sge	20 17 51	+16 34.4	11.2	(0.20)	B	*	224	186
577	V1774 Cyg	20 19 27	+50 18	12.6	15.0	V	E	285	285
578	V1775 Cyg	20 21 56	+47 10.6	13.0	13.7	R	LB	288	288
579	V1776 Cyg	20 22 09	+46 20.7	17.2	18.4	V	NL	290	290
580	V1777 Cyg	20 23 00	+42 23	15.5	21	U	UV	300	
581	V1778 Cyg	20 23 36	+41 54.9	17.0	18.0	U	UV	278	
582	V1779 Cyg	20 24 36	+40 18.5	15.0	18.3	U	UV	278	
583	V1780 Cyg	20 25 24	+41 32.1	16.2	20.0	U	UV	278	
584	V1781 Cyg	20 25 36	+41 09.4	15.2	17.5	U	UV	278	
585	V1782 Cyg	20 29 11	+47 34.7	12.8	14.8:	R	SR	288	288

№	Name	$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min	Type		References	
586	V359 Cep	$20^h29^m47^s$	+60°10!5	14.9	(15.5	P	SR:	210	210
587	V1783 Cyg	20 30 00	+39 42	16.3	(21	U	UV	300	
588	V1784 Cyg	20 32 36	+48 52.5	13.7	14.4	R	LB	288	288
589	V1785 Cyg	20 33 48	+41 01.0	16.8	17.8	U	UV	278	
590	V1786 Cyg	20 35 17	+59 57.0	14.5	(15.3	P	EA	210	210
591	V1787 Cyg	20 36 28	+55 05.9	12.4	13.6	P	EA	309	310
592	V1788 Cyg	20 40 44	+38 16.7	13.0	14.5	P	CEP:	309	314
593	CF Oct	20 42 13	−80 19.2	8.27	(0.3)	V	RS	442	CPD
594	V1789 Cyg	20 43 18	+42 26	16.2	18.2	U	UV	316	
595	V343 Pav	20 43 38	−72 23.8	7.99	8.02	V	ACV	484	CPD
596	V1790 Cyg	20 48 18	+43 14	16.8	21.0	P	UV	316	
597	V1791 Cyg	20 48 48	+40 50	16.6	18.3	U	UV	316	
598	V1792 Cyg	20 49 35	+37 48.1	7.29	(0.09)	V	ELL	001	BD
599	V1793 Cyg	20 49 54	+43 26	14.3	19.0	U	UV	319	
600	V1794 Cyg	20 52 07	+44 11.7	7.23	(0.17)	V	FKCOM	327	326
601	V1795 Cyg	20 53 00	+40 17	16.3	18.6	U	UV	316	
602	QT Vul	20 53 53	+23 44.1	10.3	11.4	V	SR	269	BD
603	V1796 Cyg	20 59 00	+43 58	16.6	19.0	U	UV	316	
604	V1797 Cyg	20 59 30	+41 45	15.2	16.5	U	UV	319	
605	V1798 Cyg	20 59 36	+40 29	15.7	16.7	U	UV	316	
606	V1799 Cyg	20 59 54	+42 31	16.5	17.9	U	UV	316	
607	AQ Cap	21 00 27	−18 53.5	13.0	13.9	P	EW/KW	062	063
608	FN Aqr	21 00 33	−01 30.4	7.3	(0.01)	V	DSCTC	009	BD
609	V1800 Cyg	21 01 10	+37 35	10.8	13.2	V	M	330	285
610	V1801 Cyg	21 02 52	+40 37.6	12.1:	13.3:	R	SRA	288	288
611	V1802 Cyg	21 04 19	+40 20.4	12.1	13.0	R	LB	288	288
612	V1803 Cyg	21 04 40	+38 30.0	5.19	5.27	V	BY	336	BD
613	V1804 Cyg	21 05 35	+36 58	12.5	14.5	V	LB	285	181
614	V1805 Cyg	21 05 56	+35 29.2	12.3	14.0	P	SR:	341	340
615	V1806 Cyg	21 06 54	+40 10.3	11.2:	13.2:	R	SRA	288	288
616	V1807 Cyg	21 14 06	+46 49.8	14.2	15.2	B	SR:	344	344
617	V1808 Cyg	21 14 38	+41 42.0	12.1	14.2	R	SRA	288	288
618	V1809 Cyg	21 16 35	+43 44.1	4.98	5.09	V	ELL	352	352
619	V1810 Cyg	21 23 55	+44 57.0	19.5	20.4	B	RR:	353	353
620	V1811 Cyg	21 26 49	+38 57.4	10.1	12.3	P	INS:	341	341
621	V1812 Cyg	21 28 39	+38 37.8	13.5	(16.0	P	M	341	341
622	V1813 Cyg	21 31 42	+48 03.7	13.7	16.1	V	EA/SD	361	
623	V360 Cep	21 39 21	+68 09.7	8.3	(0.03)	V	DSCTC	214	BD
624	V361 Cep	21 41 41	+65 52.9	10.07	10.20	V	INA	215	BD
625	V1814 Cyg	21 42 18	+53 28.7	11.8	12.28	B	IA	363	367
626	BD Ind	21 53 18	−62 05.0	7.5	(0.01)	V	ACV	066	CPD
627	BE Ind	21 56 16	−59 48.6	8.4	(0.02)	V	DSCTC	448	CPD
628	V1815 Cyg	21 59 49	+47 50.5	11.2	11.5	P	RRC	020	369
629	V365 Lac	22 03 53	+47 59.3	6.27	(0.08)	V	ELL	283	BD
630	FO Aqr	22 15 19	−08 36.2	13.4	14.4	P	XPR	011	011

№	Name		$\alpha_{1950.0}$	$\delta_{1950.0}$	Max	Min		Type	References	
631	IN	Peg	$22^h19^m03^s$	+11°57'.2	4.85	5.05	V	GCAS	171	BD
632	CG	Oct	22 20 22	−89 04.6	6.85	(0.04)	B	DSCTC	443	CPD
633	SU	UMi	22 26 24	+88 35.4	16.0	(17.4	P	EA/SD:	356	356
634	TY	PsA	22 46 56	−27 22.8	12.0	17	B	UGSU	196	196
635	BP	Gru	22 58 56	−45 06.5	7.6	(0.004)	B	ACVO	440	CoD
636	CH	Oct	23 01 33	−78 43.0	15.8	16.6	P	RR:	348	347
637	V362	Cep	23 13 27	+85 50.0	13.0	19.0	P	M:	222	222
638	V649	Cas	23 14 17	+61 41.4	6.53	(0.10)	V	EA/DM	128	BD
639	IO	Peg	23 15 30	+13 02.9	15.0	16.5	P	RRAB	172	
640	IP	Peg	23 20 39	+18 08.7	12.0	18.6	B	UG+E	172	173
641	CK	Tuc	23 28 47	−73 28.6	15.3	15.8	P	RRC	348	347
642	CI	Oct	23 31 29	−81 22.7	15.0	15.5	P	E	348	347
643	CL	Tuc	23 40 49	−73 47.4	15.2	15.7	P	EA/KE:	348	347
644	V650	Cas	23 46 13	+64 35.9	6.41	(0.02)	V	ACV	134	BD
645	V651	Cas	23 46 14	+57 28.8	10.5	11.0	P	EW/KW	020	137
646	V652	Cas	23 49 46	+57 50	11.7	12.1	V	LB	140	139
647	V653	Cas	23 54 24	+58 09	13.9	15.4	V	SR	140	155
648	V654	Cas	23 57 48	+60 43.0	11.1	(0.5:)	P	EA/D	156	157

Table II

LR And = 007 = HD 1826(A3) [001] = BD +28°49 (7.5).
LS And = 014 = m [002] = NSV 00191.
LT And = 015 = 14 [004].
LU And = 017 = GR273 [006].
LV And = 035 = RRV−1 [007].
LW And = 036 = RRV−2 [007].
LX And = 037 = RRV−3 [007].
LY And = 038 = RRV−6 [007].
LZ And = 040 = RRV−8 [007].
MM And = 041 = RRV−7 [007].
MN And = 042 = RRV−9 [007].
MO And = 044 = RRV−11 [007].
MP And = 045 = RRV−12 [007].
MQ And = 046 = RRV−13 [007].
MR And = 047 = RRV−14 [007].
MS And = 048 = RRV−16 [007].
MT And = 050 = RRV−17 [007].
MU And = 051 = RRV−18 [007].
MV And = 053 = RRV−20 [007].
MW And = 054 = RRV−22 [007].
MX And = 055 = RRV−23 [007].
MY And = 056 = RRV−24 [007].
MZ And = 057 = RRV−28 [007].

FN Aqr = 608 = HD 200356 (F2) [009] = BD −1°4098 (7.3).
FO Aqr = 630 = H 2215−086 [010, 011].
V1360 Aql = 526 = OH/IR 30.7+0.4 [012].
V1361 Aql = 528 = OH/IR 30.1−0.2 [012].
V1362 Aql = 529 = OH/IR 30.1−0.7 [012].
V1363 Aql = 533 = OH/IR 32.0−0.5 [012].
V1364 Aql = 534 = OH/IR 31.7−0.8 [012].
V1365 Aql = 535 = OH/IR 32.8−0.3 [012].
V1366 Aql = 536 = OH 39.7+1.5 [014] = AFGL 2290 [012].
V1367 Aql = 537 = OH/IR 39.9+0.0 [012].
V1368 Aql = 539 = OH/IR 42.3−0.1 [012].
V1369 Aql = 542 = OH/IR 45.5+0.1 [012].
V1370 Aql = 543 = Nova Aql 1982 [015, *Honda*].
V1371 Aql = 550 = S 8132 [017] = NSV 12212.
V1372 Aql = 552 = S8136 [017] = NSV 12234.
V1373 Aql = 555 = S 8141 [017] = NSV 12256.
V1374 Aql = 556 = S 8144 [017] = NSV 12290.
V1375 Aql = 557 = S 8146 [017] = NSV 12297.
V1376 Aql = 565 = 711.1933 [019] = NSV 12611.
V823 Ara = 370 = Var in Ara [021].
V824 Ara = 447 = HD 155555 (G5) [024] = = LDS 587 A [023].

V825 Ara = 485 = V2 (NGC 6397) [026].
V826 Ara = 486 = new var, $\bar{\bar{m}}$ 15.05 (NGC 6397) [027] = V3 (NGC 6397).
V827 Ara = 487 = V4 (NGC 6397) [025].
V361 Aur = 105 = GD 66 [028].
V362 Aur = 110 = BD + 29°897 (8.0) [030].
V363 Aur = 126 = Lanning 10 [031].
CQ Boo = 325 = S 10807 [034].
ι Boo = 320 = ι Boo [354] = 21 Boo = HR 5350 [036] = ADS 9198 A = BD +52°1784 (4.5) = NSV 06610.
BO Cam = 066 = СПЗ 1148 [037] = NSV 01084.
BP Cam = 067 = СПЗ 1149 [037] = NSV 01108.
BQ Cam = 068 = V 0332+53 [039].
BR Cam = 099 = G 191–16 [041].
BS Cam = 107 = HD 34409 (F2) [043] = BD +69°315 (8.0) = NSV 01936.
BT Cam = 288 = G255–2 [045].
BU Cam = 292 = СПЗ 596 [047] = NSV 05772.
DX Cnc = 228 = G 51–15 [049].
DY Cnc = 229 = 1, 2 (Praesepe) [051].
DZ Cnc = 230 = 3 (Praesepe) [051].
EE Cnc = 232 = 4 (Praesepe) [051].
EF Cnc = 234 = 2, 1954 [052] = Wr 100 [053] = = NSV 04187.
EG Cnc = 236 = Var in Cnc [055].
HM CMa = 187 = Var [056].
HN CMa = 190 = HR 2724 [057, *Baade*] = CoD −27°3761 (7.3).
HO CMa = 192 = HD 55817 (B9) [058] = CoD −30°4123 (8.2).
BG CMi = 197 = 3A 0729+103 [059].
AQ Cap = 607 = HV 6225 [061] = КЗП 5321 = = NSV 13478.
V386 Car = 188 = HD 54118 (A0) [064] = CPD −56°1232 (5.7).
V387 Car = 193 = HD 56350 (A0) [064] = CPD −53°1284 (7.3).
V388 Car = 194 = HD 58292 (A0) [065] = CPD −55°1224 (7.8).
V389 Car = 195 = HD 58448 (B8) [066] = CPD −61°814 (7.3).
V390 Car = 204 = HR 2971 [064] = CoD −52°2061 (6.5).
V391 Car = 219 = Cox c (NGC 2516) [068, 069] = NGC 2516–104 [070].
V392 Car = 220 = Cox 38 (NGC 2516) [073, 068, 069].
V393 Car = 221 = BV 674 [074] = HD 66260 (F0) [075] = CPD−61°941 (7.6) = = NSV 03859.
V394 Car = 226 = 119.1934 = HV 8126 [077] = = КЗП 1283 = NSV 04016.
V395 Car = 246 = 5 [079] = 2S 0921–630.
V396 Car = 254 = LSS 1374 = HD 86161 (Oe) [081] = CPD −57°2420 (8.2).
V397 Car = 256 = BV 1203 [082] = CPD −65°1215 (8.6) = HD 87072 (K0) = = NSV 04705.
V398 Car = 264 = HD 90657 (Oa) [084] = CPD −58°2205 (9.2).
V399 Car = 265 = HR 4110 [094, 095, 096, 097, 098, 099] = CPD−57°3256 (6.4) = NSV 04865.
V400 Car = 267 = 11 (NGC 3293) [102].
V401 Car = 268 = 10 (NGC 3293) [102].
V402 Car = 269 = 12 (NGC 3293) [103].
V403 Car = 270 = 16 (NGC 3293) [102].
V404 Car = 271 = 23 (NGC 3293) [101].
V405 Car = 272 = 14 (NGC 3293) [102].
V406 Car = 273 = 18 (NGC 3293) [102].
V407 Car = 275 = IC 2602–17 = CPD −64°1374 (7.2) [104].
V408 Car = 278 = CPD−62°1837 (9.4) = HDE 308122 (K0) = VB B (A $9^m_.92$V; B $10^m_.14$–$10^m_.93$V, 4″; C $13^m_.11$ V, 8″) [105].
V639 Cas = 001 = BD + 62°2356 (6.5) = HD 225094 (B1) [107, 108].
V640 Cas = 002 = HR5 = ADS 61 [109] = BD +57°2865 (6.5).
V641 Cas = 004 = BD + 63°3 (8.7) [108].
V642 Cas = 005 = BD +63°17 (9.3) [111] = = NSV 00101.
V643 Cas = 012 = Wr 63 [118] = NSV 00171.
V644 Cas = 018 = Wr 67 [118] = NSV 00366.
V645 Cas = 019 = CCS 65 [121].
V646 Cas = 025 = SVS 972 [123] = NSV 00525.
V647 Cas = 052 = СПЗ 2510 [126].
V648 Cas = 064 = Wr 37 [118] = BD+57°647 (8.9) [127].
V649 Cas = 638 = HR 8854 [128] = BD+61°2413 (6.5).
V650 Cas = 644 = HD 9017 [131] = BD+64°1861 (6.5).
V651 Cas = 645 = BV 326 [137] = NSV 14717.
V652 Cas = 646 = WS 691 [139] = NSV 14733.
V653 Cas = 647 = CSS 738 [140] = 91 [155].
V654 Cas = 648 = СПЗ 2511 [156] = звезда сравнения "b" для CG Cas/comparison star "b" for CG Cas [157].

V829 Cen = 281 = HD 101309 (G5) [159, 024] = = CoD − 38°7259 (8.0).
V830 Cen = 283 = 1E 1145.1−6141 [164].
V831 Cen = 301 = HR 4975 [167, 095, 096, 168, 169] = NSV 06133 = = CPD − 59°4815 (5.1).
V832 Cen = 310 = V168 (NGC 5139) [176, *Hertzsprung*].
V833 Cen = 311 = V56 (NGC 5139) [026].
V834 Cen = 318 = E 1405−451 [178] = 1 [179].
V835 Cen = 319 = He 2−106 [185] = = NSV 06587 = PK 312−2°1 [189].
V836 Cen = 324 = HD 129929 (B5) [168] = = CoD−36°9605 (7.5).
ν Cen = 317 = HR 5190 [097, 199] = = CoD−41°8171 (3.7) = HD 120307 (B2) [200] = NSV 06454.
V357 Cep = 032 = 54.1933 [203] = NSV 00700.
V358 Cep = 043 = 460.1934 [206] = = NSV 00817.
V359 Cep = 586 = GR 311 [210].
V360 Cep = 623 = BD+67°1343 (8.4) [214].
V361 Cep = 624 = BD+65°1637 (9.4) [215].
V362 Cep = 637 = 59.1933 [203] = NSV 14466 [222].
BD Cet = 008 = HD 1833 (G5) [226] = = BD−10°58 (7.8).
BE Cet = 009 = HD 1835 (G0) [234] = = BD−13°60 (6.5).
BF Cet = 011 = PS 4452−1357 [240].
BG Cet = 016 = HR 151 [245] = = CoD−23°220 (6.1).
BT Cir = 322 = HD 129041 (A2) [247] = = CPD−61°4674 (7.4).
BU Cir = 323 = HD 129557 (B3) [249] = = CPD−55°6150 (6.3).
BV Cir = 326 = HD 132209 (A5) [250] = = CPD−64°3066 (6.4).
α Cir = 321 = HR 5463 [251] = = CPD−64°2977 (3.7) = HD 128898 (F0) [065].
TW Col = 180 = CoD−42°2282 (7.0) = = HD 41089 (B8) [064].
HX Com = 289 = СПЗ 2557 [252, *Шугаров*].
HY Com = 290 = BD+16°2356 (9.4) [253, 254].
HZ Com = 291 = BD+25°2511 (9.0) [174, 023].
II Com = 293 = 2 [256].
IK Com = 294 = 3 [256].

V1762 Cyg = 540 = HR 7275 [257] = = BD+52°2350 (6.2) = NSV 11775.
V1763 Cyg = 546 = PG 7 [259, *P. Guida*].
V1764 Cyg = 549 = BD+27°3444 (7.8) = = HD 185151 (K0) [261, *Fekel*].
V1765 Cyg = 561 = HR 7551 [262, 263] = = BD+33°3602 (6.9) = A [264] = = NSV 12436.
V1766 Cyg = 562 = 2 [269].
V1767 Cyg = 563 = 3 [269].
V1768 Cyg = 566 = HR 7678 [270] = = BD+31°3925 (6.0) = HD 190603 (B0) [107, 174].
V1769 Cyg = 569 = BD+35°4001 (8.5) [272, 273] = HD 191765 (Ob) = NSV 12863.
V1770 Cyg = 570 = BD+37°3821 (7.1) [273] = = HD 192163 (Ob) = NSV 12896.
V1771 Cyg = 573 = Var [276].
V1772 Cyg = 574 = R6 [278].
V1773 Cyg = 575 = BD+45°3139 (6.6) = = HD 193536 (B1) [200, 283] = = NSV 13005.
V1774 Cyg = 577 = LD 23 [285].
V1775 Cyg = 578 = BC 235 [288].
V1776 Cyg = 579 = Lanning 90 [290].
V1777 Cyg = 580 = R12 [300].
V1778 Cyg = 581 = R7 [278].
V1779 Cyg = 582 = R 8 [278].
V1780 Cyg = 583 = R9 [278].
V1781 Cyg = 584 = R10 [278].
V1782 Cyg = 585 = BC 236 [288].
V1783 Cyg = 587 = B 4 [300].
V1784 Cyg = 588 = BC 237 [288].
V1785 Cyg = 589 = R11 [278].
V1786 Cyg = 590 = GR312 [210].
V1787 Cyg = 591 = S 3840 [306] = NSV 13198.
V1788 Cyg = 592 = 544.1936 [313] = NSV 13250.
V1789 Cyg = 594 = B 53 [316].
V1790 Cyg = 596 = R1 [316].
V1791 Cyg = 597 = B 54 [316].
V1792 Cyg = 598 = BD+37°4076 (7.2) = = HD 198784 (B5) [001, 200].
V1793 Cyg = 599 = B 52 [319].
V1794 Cyg = 600 = HD 199178 (G5) [325, *Sandmann*].
V1795 Cyg = 601 = B 55 [316].
V1796 Cyg = 603 = B 56 [316].
V1797 Cyg = 604 = B 51 [319].
V1798 Cyg = 605 = B 57 [316].
V1799 Cyg = 606 = B 58 [316].

V1800 Cyg = 609 = LD 36 [285].
V1801 Cyg = 610 = BC 242 [288].
V1802 Cyg = 611 = BC 243 [288].
V1803 Cyg = 612 = 61 Cyg A [334, 336] = = HR8085 = BD+38°4343 (5.0) = = NSV 13543.
V1804 Cyg = 613 = S 9106 [181] = LD 39 [285] = = NSV 13553.
V1805 Cyg = 614 = SVS 497 [340] = КЗП 5360 = = NSV 13557.
V1806 Cyg = 615 = BC 244 [288].
V1807 Cyg = 616 = Var [344].
V1808 Cyg = 617 = BC 245 [288].
V1809 Cyg = 618 = 68 Cyg [349] = HR 8154 = = BD+43°3877 (5.3).
V1810 Cyg = 619 = R15 [353].
V1811 Cyg = 620 = BD+38°4507 (9.5) [357] = = Wr 14 = КЗП 8659 = NSV 13741.
V1812 Cyg = 621 = Ross 121 [358] = КЗП 5428 = = NSV 13757.
V1813 Cyg = 622 = 1339 [361].
V1814 Cyg = 625 = NGC 7128-4 [363].
V1815 Cyg = 628 = BV 120 [369, *Geyer*] = = NSV 14002.
AB Dor = 118 = CPD–65°475 (7.1) = = HD 36705 (G0) = 1 E 052840– –6529.5 [371].
DO Dra = 282 = 3 A 1148+719 = 2A 1150+ +720 [398, 399] = z [400] = = PG 1140+719 ≠ YY Dra.
DP Dra = 296 = Gliese 487 [403].
DQ Dra = 355 = HR 6127 [415] = BD +55° 1845 (5.7).
DR Dra = 483 = 29 Dra [419] = BD +74°717 (7.0).
DS Dra = 501 = K1–16 [421].
DT Dra = 532 = S 9362 [423] = NSV 11423.
EI Eri = 077 = BD–8°801 (7.2) = HD 26337 (G0) [429, *Fekel*].
OU Gem = 183 = BD + 18°1214 (7.4) = HD 45088 (K0) [436, *Henry*].
BP Gru = 635 = CoD–45° 14901 (7.6) = HD 217522 (A5) [440].
V776 Her = 371 = 45 Her [407, 444, 131] = BD +5°3272 (5.2) = NSV 07970.
V777 Her = 372 = GD 358 [445].
V778 Her = 373 = S 10849 [447].
V779 Her = 374 = S 10850 [447].
V780 Her = 378 = S 10851 [447].
V781 Her = 379 = S 10852 [447].
V782 Her = 380 = S 10853 [447].
V783 Her = 381 = S 10854 [447].
V784 Her = 384 = S 10855 [447].
V785 Her = 385 = S 10856 [447].
V786 Her = 387 = S 10857 [447].
V787 Her = 388 = S 10858 [447].
V788 Her = 389 = S 10859 [447].
V789 Her = 390 = S 10860 [447].
V790 Her = 392 = S 10861 [447].
V791 Her = 393 = S 10862 [447].
V792 Her = 394 = BD+49°2596 (8.2) = HD 155638 (K0) [449].
V793 Her = 395 = S 10863 [447].
V794 Her = 404 = S 10864 [447].
V795 Her = 420 = PG 1711+336 [457].
V796 Her = 426 = S 10865 [447].
V797 Her = 464 = S 10866 [447].
V798 Her = 465 = Var 14 (NGC 6341) [464, *Guthnick, Prager*].
V799 Her = 466 = S 8612 [181] = NSV 08515.
V800 Her = 467 = S 10867 [447].
V801 Her = 468 = S 8613 [181] = NSV 08543.
V802 Her = 469 = S 10868 [447].
V803 Her = 470 = S 10869 [447].
V804 Her = 471 = S 10870 [447].
V805 Her = 472 = S 10871 [447].
V806 Her = 473 = S 10872 [447].
V807 Her = 474 = S 10873 [447].
V808 Her = 475 = S 10874 [447].
V809 Her = 476 = S 10875 [447].
V810 Her = 478 = S 10876 [447].
V811 Her = 480 = S 10877 [447].
V812 Her = 481 = S 10878 [447].
V813 Her = 482 = S 10879 [447].
V814 Her = 490 = BD + 50°2457 (7.5) = HD 161796 (F 8p) [174, 466, 467].
V815 Her = 498 = BD +29°3187 (8.2) = HD 166181 (G5) [023].
V816 Her = 523 = G 141–29 [470] = NSV 11248.
LM Hya = 227 = HR 3321 [472, 473] = BD –3°2345 (6.2) = NSV 04080.
LN Hya = 297 = HR 4912 [474, 098, 168] = = CoD–25°9508 (6.9) = BV 841 [475] = NSV 06029.
BG Hyi = 023 = CPD–71°61 (7.9) = HD 8781 (A5) [476, 477].
BH Hyi = 026 = S 6685 [347] = NSV 00530.
BI Hyi = 028 = S 6687 [347] = NSV 00574.
BK Hyi = 029 = S 6688 [347] = NSV 00578.
BL Hyi = 030 = H 0139–68 [478].

BM Hyi = 031 = CPD–61°139 (6.3) = HD 10840 (B9) [066].

BN Hyi = 065 = HR 981A [481] = CPD–79°91 (5.6).

BD Ind = 626 = HD 208217 (A0) [066] = CPD –62°6281 (7.4).

BE Ind = 627 = HD 208664 (A2) [448] = CPD –60°7529 (8.0).

V365 Lac = 629 = HD 209961 (B3) [283] = BD +47°3692 (6.5).

DL Leo = 249 = var [450].

DM Leo = 258 = SVS 968 [452] = КЗП 1574 = = NSV 04782.

DN Leo = 274 = BD + 10°2179 (9.0) [454] = = NSV 04917.

DO Leo = 276 = PG 1038 + 155 [308].

DP Leo = 280 = var [456].

DQ Leo = 284 = 93 Leo [458] = BD+21°2358 (4.0).

β Leo = 285 = β Leo [459] = BD+15°2383 (2.0) = NSV 05349.

RZ LMi = 252 = 2 [173] = PG 0948+344 [308].

SS LMi = 266 = var [460].

ST LMi = 279 = CW 1103 + 254 [461].

TU Lep = 102 = HD 32966 (B9) [065, 064] = = BD–14°1045 (7.1).

TV Lep = 106 = СПЗ 2589 [172].

TW Lep = 174 = HD 37847 (K0) [401] = BD –20°1149 (7.7).

GW Lib = 329 = Novalike object [402].

GX Lib = 330 = HD 136905 (K0) [404] = BD –6°4193 (7.3).

GY Lib = 331 = HV 11598 [405] = NSV 07060.

GZ Lib = 334 = 33 Lib [407, 408] = BD –16°4093 (7.0) = NSV 07104.

HH Lib = 335 = HV 10676 [409] = КЗП 2361 [410] = NSV 07127.

HP Lup = 327 = HD 134518 (A3) [411] = CoD –35°10101 (8.3).

HQ Lup = 332 = CoD–39°9848 (7.5) [248].

VX Lyn = 196 = RR VI–34 [007].

VY Lyn = 198 = RR VI–35 [007].

VZ Lyn = 199 = RR VI–36 [007].

WW Lyn = 200 = RR VI–37 [007].

WX Lyn = 201 = RR VI–38 [007].

WY Lyn = 202 = RR VI–39 [007].

WZ Lyn = 203 = RR VI–40 [007].

XX Lyn = 205 = RR VI–41 [007].

XY Lyn = 207 = RR VI–42 [007].

XZ Lyn = 208 = RR VI–43 [007].

YY Lyn = 209 = RR VI–44 [007].

YZ Lyn = 210 = RR VI–45 [007].

ZZ Lyn = 212 = RR VI–46 [007].

AA Lyn = 213 = RR VI–47 [007].

AB Lyn = 214 = RR VI–49 [007].

AC Lyn = 216 = RR VI–50 [007].

AD Lyn = 217 = RR VI–52 [007].

AE Lyn = 222 = 54 Cam [412] = BD +57° 1118 (6.5).

AF Lyn = 231 = RR VII–55 [007].

AG Lyn = 233 = RR VII–57 [007].

AH Lyn = 235 = RR VII–58 [007].

AI Lyn = 237 = RR VII–59 [007].

AK Lyn = 238 = RR VII–60 [007].

AL Lyn = 239 = RR VII–61 [007].

AM Lyn = 240 = RR VII–62 [007].

AN Lyn = 245 = BD +43° 1894 (9.4) [413, 414].

V479 Lyr = 512 = S 10845 [416].

V480 Lyr = 514 = S 10846 [416].

V481 Lyr = 530 = Wr 115 [420] = КЗП 7965 [418] = NSV 11365.

V482 Lyr = 538 = S 10847 [416].

YY Men = 100 = HD 32918 (K0) [422] = CPD –75° 292 (9.0).

V648 Mon = 184 = HD 45530 (B9) [065] = BD +5°1249 (8.0).

V649 Mon = 185 = HD 47088 (B8) [201] = = BD +6°1308 (8.5).

V650 Mon = 186 = LkH$_{\alpha}$ 4 [424] = NSV 03071.

V651 Mon = 189 = *(NGC 2346) [427].

GQ Mus = 286 = Nova Mus 1983 [430].

GR Mus = 298 = 30 (2S 1254–690) [433] = = 30 (4U 1254–69) [434].

V335 Nor = 336 = F6 (NGC 5946) [432].

V336 Nor = 337 = F7 (NGC 5946) [432].

V337 Nor = 338 = F8 (NGC 5946) [432].

V338 Nor = 339 = F9 (NGC 5946) [432].

V339 Nor = 340 = F10 (NGC 5946) [432].

V340 Nor = 348 = CPD–53°7400 A (8.5) [437].

V341 Nor = 349 = Nova Nor 1983 [438].

CF Oct = 593 = BV 893 [441] = CPD–80°981 (8.4) = NSV 13267.

CG Oct = 632 = HR8294 [443, *McInally*] = = CPD–89°53 (6.5).

CH Oct = 636 = S 6601 [347] = NSV 14412.

CI Oct = 642 = S 6619 [347] = NSV 14619.

V2128 Oph = 356 = BD–8°4232 (9.0) [085].

V2129 Oph = 358 = SR9 [086] = NSV 07733.

V2130 Oph = 359 = СПЗ 1797 [088] = 20 [087] = = NSV 07744.

V2131 Oph = 361 = СПЗ 1679 [090] = = NSV 07780.

V2132 Oph = 366 = RNO 90 [091].
V2133 Oph = 369 = HD 149661 (K0) [092] = = BD−2°4211 (5.5) = BD−1°3220 (5.8).
V2134 Oph = 382 = MXB 1659−29 [093].
V2135 Oph = 383 = СПЗ 2155 [113] = = V7 (NGC 6273) [114] = = NSV 08119.
V2136 Oph = 391 = F2 (NGC 6293) [116].
V2137 Oph = 396 = V2 (NGC 6293) [116].
V2138 Oph = 397 = 60 [119] = NSV 08287.
V2139 Oph = 398 = 41 [120].
V2140 Oph = 399 = 61 [119] = NSV 08289.
V2141 Oph = 400 = 43 [120].
V2142 Oph = 401 = 123 [120].
V2143 Oph = 402 = 6 [122] = NSV 08292.
V2144 Oph = 403 = 32 [120].
V2145 Oph = 405 = V7 (NGC 6293) [117].
V2146 Oph = 406 = 24 [120].
V2147 Oph = 407 = 12 [122] = NSV 08307.
V2148 Oph = 408 = 15 [122] = NSV 08311.
V2149 Oph = 409 = 25 [120].
V2150 Oph = 410 = 47 [120].
V2151 Oph = 411 = 52 [120].
V2152 Oph = 412 = 33 [120].
V2153 Oph = 413 = 23 [122] = NSV 08336.
V2154 Oph = 414 = 54 [120].
V2155 Oph = 415 = 10 [125].
V2156 Oph = 416 = 36 [120].
V2157 Oph = 417 = 37 [120].
V2158 Oph = 418 = 57 [120].
V2159 Oph = 419 = 11 [125].
V2160 Oph = 421 = 14 [120].
V2161 Oph = 422 = 2 [125].
V2162 Oph = 423 = 59 [120].
V2163 Oph = 424 = 30 [122] = NSV 08350.
V2164 Oph = 425 = 60 [120].
V2165 Oph = 427 = 16 [120].
V2166 Oph = 428 = 7 [125].
V2167 Oph = 429 = 1 [125].
V2168 Oph = 430 = 64 [120].
V2169 Oph = 431 = 33 [122] = NSV 08365.
V2170 Oph = 432 = 65 [120].
V2171 Oph = 433 = 3 [125].
V2172 Oph = 434 = 34 [122] = NSV 08366.
V2173 Oph = 435 = 5 [125].
V2174 Oph = 436 = 67 [120].
V2175 Oph = 437 = 36 [122] = NSV 08372.
V2176 Oph = 438 = 39 [122] = NSV 08376.
V2177 Oph = 439 = 8 [125].
V2178 Oph = 440 = 105 [120].
V2179 Oph = 441 = 106 [120].
V2180 Oph = 442 = 43 [122] = NSV 08386.
V2181 Oph = 443 = 9 [125].
V2182 Oph = 444 = 99 [120].
V2183 Oph = 445 = 45 [122] = NSV 08393.
V2184 Oph = 446 = 84 [120].
V2185 Oph = 448 = 75 [119] = NSV 08401.
V2186 Oph = 449 = 76 [119] = NSV 08405.
V2187 Oph = 450 = 74 [120].
V2188 Oph = 451 = 51 [122] = NSV 08408.
V2189 Oph = 452 = 108 [120].
V2190 Oph = 453 = 93 [120].
V2191 Oph = 454 = 81 [120].
V2192 Oph = 455 = 71 [120].
V2193 Oph = 456 = 82 [120].
V2194 Oph = 457 = 79 [120].
V2195 Oph = 458 = 96 [120].
V2196 Oph = 459 = 78 [120].
V2197 Oph = 460 = 89 [120].
V2198 Oph = 461 = 97 [120].
V2199 Oph = 462 = 98 [120].
V2200 Oph = 463 = 83 [120].
V2201 Oph = 488 = HV 11031 [129] = КЗП 3410 = = NSV 09602.
V2202 Oph = 489 = HV 11035 [129] = КЗП 3422 = = NSV 09635.
V2203 Oph = 491 = var [132] = КЗП 7725 = = NSV 09738.
V2204 Oph = 503 = 46 [135] = NSV 10797.
V1085 Ori = 103 = 43G Ori [138] = HD 33647 (B9) [072] = NSV 01862.
V1086 Ori = 108 = 25 Ori [142] = NSV 01967.
V1087 Ori = 109 = B10 Ori [144].
V1088 Ori = 111 = Ab 99 Ori [145].
V1089 Ori = 112 = Ab 100 Ori [145].
V1090 Ori = 113 = B12 Ori [144].
V1091 Ori = 114 = Ab103 [146].
V1092 Ori = 115 = Ab113 [146].
V1093 Ori = 116 = BD−0°977 (8.8) [147,072] = = WH 117 [141] = NSV 02054.
V1094 Ori = 117 = Ab123 [146].
V1095 Ori = 119 = Ab 85 Ori [145].
V1096 Ori = 120 = Ab 95 Ori [145].
V1097 Ori = 121 = B13 Ori [144].
V1098 Ori = 122 = Ab117 [146].
V1099 Ori = 123 = BD−1°933 (8.8) [072].
V1100 Ori = 124 = Ab124 [146].
V1101 Ori = 125 = BD−4°1162 (8.8) [072] = = П 867 [148].
V1102 Ori = 127 = B19 Ori [149].
V1103 Ori = 128 = R9 Ori [150].

V1104 Ori = 129 = No.8 Ori [151].
V1105 Ori = 130 = Ab127 [146].
V1106 Ori = 131 = B11 Ori [144].
V1107 Ori = 132 = BD+0°1113 (8.6) [072].
V1108 Ori = 133 = Ab121 [146].
V1109 Ori = 134 = Ab 98 Ori [145].
V1110 Ori = 135 = Ab115 [146].
V1111 Ori = 136 = Ab111 [146].
V1112 Ori = 137 = Ab 96 Ori [145].
V1113 Ori = 138 = Ab104 [146].
V1114 Ori = 139 = Ab 87 Ori [145].
V1115 Ori = 140 = Ab 90 Ori [145].
V1116 Ori = 141 = No.7 Ori [151] = B 25 Ori [149] = П 1471 [148].
V1117 Ori = 142 = Ab 106 [146].
V1118 Ori = 143 = E6 [152] = NSV 02229.
V1119 Ori = 144 = Ab 107 [146].
V1120 Ori = 145 = Ab 125 [146].
V1121 Ori = 146 = No. 1 Ori [151].
V1122 Ori = 147 = Ab 126 [146].
V1123 Ori = 148 = Ab 88 Ori [145].
V1124 Ori = 149 = 96 [154] = Ab 131 [146] = = NSV 02371.
V1125 Ori = 150 = R 11 [150].
V1126 Ori = 151 = AB 116 [146].
V1127 Ori = 152 = Ab 89 Ori [145].
V1128 Ori = 153 = 40 [154] = Ab 114 [146] = = NSV 02396.
V1129 Ori = 154 = Ab 86 Ori [145].
V1130 Ori = 155 = BD−0° 1018 (9.2) [072].
V1131 Ori = 156 = R 12 [150].
V1132 Ori = 157 = Ab 102 [146].
V1133 Ori = 158 = HD 37210 (B9) [141].
V1134 Ori = 159 = Ab 110 [146].
V1135 Ori = 160 = Ab 120 [146].
V1136 Ori = 161 = Ab 101 [146].
V1137 Ori = 162 = Ab 119 [146].
V1138 Ori = 163 = 51.1903 [158] = Ab 118 [146] = NSV 02461.
V1139 Ori = 164 = Ab 122 [146].
V1140 Ori = 165 = Ab 109 [146].
V1141 Ori = 166 = Ab 92 Ori [145].
V1142 Ori = 167 = No. 4 Ori [151] = П 2618 [148].
V1143 Ori = 168 = var [160].
V1144 Ori = 169 = Ab 105 [146].
V1145 Ori = 170 = Ab 91 Ori [145].
V1146 Ori = 171 = Ab 93 Ori [145].
V1147 Ori = 172 = HD 37633 (B9) [162] = = NSV 02532.
V1148 Ori = 173 = HD 37642 (B9) [141].
V1149 Ori = 175 = HD 37824 (G5) [163] = BD +3° 1007 (7.3).
V1150 Ori = 176 = R 13 [150].
V1151 Ori = 177 = Ab 94 Ori [145].
V1152 Ori = 178 = Ab 128 [146].
V1153 Ori = 179 = Ab 97 Ori [145].
V1154 Ori = 181 = 10 (NGC 2169) [166].
V1155 Ori = 182 = HD 43819 (B8) [131, 483] = BD+17°1203 (6.5).
V343 Pav = 595 = HD 197417 (A0) [065, 484] = CPD−72°2554 (7.4).
IN Peg = 631 = HR 8520 [171] = BD +11°4784 (5.5).
IO Peg = 639 = СПЗ 2679 [172].
IP Peg = 640 = 4 [173] = СПЗ 2549 [172].
V472 Per = 033 = HD 12953 (A2p) [174] = = BD+57°494 (6.5).
V473 Per = 034 = BD+56°469 (8.5) [180].
V474 Per = 039 = HD 14489 (A2p) [174] = = BD+55°598 (5.7).
V475 Per = 049 = HD 14956 (B1) [174] = = BD+57°568 (7.0).
V476 Per = 058 = RRV−29 [007].
V477 Per = 059 = RRV−30 [007].
V478 Per = 060 = RRV−32 [007].
V479 Per = 062 = RRV−33 [007].
V480 Per = 063 = HD 17378 (F5p) [174] = = BD+56°718 (6.5).
V481 Per = 078 = S 8550 [181] = NSV 01504.
V482 Per = 079 = S 8552 [181] = NSV 01525.
BB Phe = 013 = HR 119 [183] = CoD−41°116 (6.5).
BC Phe = 022 = HD 8435 (G0) [159; 184, *Koen*] = CoD−57°268 (8.3).
TT Pic = 104 = HD 34631 (B9) [064] = = CoD−46°552 (7.1).
AP Psc = 003 = 5 Cet [187] = BD−3°3 (6.5).
AQ Psc = 020 = HD 8152 (F8) [188] = = BD+6°203 (8.5).
AR Psc = 021 = HD 8357 (G5) [192].
AS Psc = 024 = S 10828 [190].
TY PsA = 634 = BV 981 [195] = PS 74 [196] = = NSV 14328.
QW Pup = 191 = HD 55892 (F0) [198] = = CoD−46°2977 (4.8).
QX Pup = 206 = OH 0739−14 [202].
QY Pup = 211 = HR 3026 [205] = BD − 15°2049 (6.2) = NSV 03738.
QZ Pup = 215 = HR 3084 [208] = CoD −38°3769 (4.9) = NSV 03789.
V335 Pup = 218 = U 168 [211] = HD 65227 (G0) [212] = BD−22°2088 (9.1).

V336 Pup = 223 = HD 66624 (B9) [213,064] = = CoD–40°3776 (6.2).
V337 Pup = 224 = CoD–29°5439 (7.6) [066].
TT Ret = 081 = HD 27463 (A0) [064] = = CPD–61°317 (6.0).
QR Sge = 541 = 209 BAC (516) [216].
QS Sge = 548 = 421.1934 [217] = КЗП 4733 [218] = NSV 12181.
QT Sge = 560 = HD 187282 (Oa) [219].
QU Sge = 564 = V3 (NGC 6838) [221].
QV Sge = 576 = IC 4997 [223] = PK 58–10°1 [186].
V4070 Sgr = 494 = 111 (Sgr I) [225] = = NSV 09897.
V4071 Sgr = 495 = 5 (Sgr I) [225] = NSV 09903.
V4072 Sgr = 496 = HD 164270 (OBp) [227, 228] = CoD–32°13623 (8.7).
V4073 Sgr = 497 = 10 [229, *Leavitt*] = КЗП 3775 [230] = NSV 10244.
V4074 Sgr = 499 = AS 295B [231].
V4075 Sgr = 500 = var [232].
V4076 Sgr = 507 = Anon 2 [233].
V4077 Sgr = 509 = Nova Sgr 1982 [235, *Honda*].
V4078 Sgr = 510 = Anon 1 [233].
V4079 Sgr = 515 = F9 [238].
V4080 Sgr = 516 = F13 [238].
V4081 Sgr = 517 = V5 (NGC 6681) [238].
V4082 Sgr = 518 = 3 [125] = NSV 11234.
V4083 Sgr = 519 = F8 [238].
V4084 Sgr = 520 = F5 [238].
V4085 Sgr = 521 = F10 [238].
V4086 Sgr = 522 = F7 [238].
V4087 Sgr = 524 = F6 [238].
V4088 Sgr = 531 = HD 174403 (B9) [265] = BD –20°5288.
V4089 Sgr = 547 = HD 184035 (A2) [242, 243] = = CoD–40°13356 (6.0) = NSV 12133.
V4090 Sgr = 554 = HR 7464 [174] = CoD –39°13371 (6.8).
V4091 Sgr = 567 = HD 190540 (G5) [246] = BD –19°5704 (8.3).
V928 Sco = 343 = HD 142884 (B9) [248] = CoD –23°12597 (7.4).
V929 Sco = 345 = HD 144334 (B8) [248] = CoD –23°12700 (6.2).
V930 Sco = 346 = СПЗ 1678 [090] = NSV 07482.
V931 Sco = 347 = СПЗ 1683 [090] = NSV 07515.
V932 Sco = 350 = СПЗ 1691 [090] = NSV 07606.
V933 Sco = 351 = HD 147010 (B9) [266] = BD –19°5979 (7.8).
V934 Sco = 352 = СПЗ 2112 [267] = NSV 07646.
V935 Sco = 353 = СПЗ 1770 [279] = NSV 07664.
V936 Sco = 354 = HD 147890 (B8) [065, 248] = CoD–29°12529 (7.9).
V937 Sco = 357 = СПЗ 1796 [088] = = NSV 07728.
V938 Sco = 360 = СПЗ 1690 [090] = = NSV 07762.
V939 Sco = 362 = СПЗ 1798 [088] = = NSV 07793.
V940 Sco = 363 = СПЗ 1799 [088] = = NSV 07794.
V941 Sco = 364 = СПЗ 1800 [088] = = NSV 07807.
V942 Sco = 365 = СПЗ 1774 [279] = = NSV 07815.
V943 Sco = 367 = СПЗ 2119 [267] = = NSV 07840.
V944 Sco = 368 = СПЗ 2117 [267] = = NSV 07841.
V945 Sco = 375 = Segg 253 (NGC 6231) [280].
V946 Sco = 376 = Segg 261 (NGC 6231) [280].
V947 Sco = 377 = Segg 110 (NGC 6231) [280].
V948 Sco = 386 = CoD–37°11216 (9.0) [248].
V949 Sco = 479 = BS 6522 [168] = = CoD–34°11757 (6.4).
V950 Sco = 484 = BV 547 [286] = = CoD–40°11648 (7.7) = NSV 09246.
V951 Sco = 492 = HD 162725 (A0) [065, 168, 072, 289] = CoD–34°12228 (7.5).
V433 Sct = 502 = BD–14°5037 (8.2) [291].
V434 Sct = 504 = OH/IR 20.3–0.1 [012].
V435 Sct = 505 = OH/IR 19.2–1.0 [012].
V436 Sct = 506 = OH/IR 23.7+1.2 [012].
V437 Sct = 511 = OH 26.5+0.6 [292, 293, 294].
V438 Sct = 513 = OH/IR 26.2–0.6 [012].
V439 Sct = 525 = OH/IR 28.7–0.6 [012].
V440 Sct = 527 = OH/IR 26.4–1.9 [012].
MQ Ser = 328 = 5 Ser [295] = BD+2°2944 (5.0).
MR Ser = 341 = PG 1550+191 [296].
MS Ser = 344 = HD 143313 (K5) [298] = = BD+25°3003 (8.1).
MT Ser = 477 = Abell 41 [301, 302] = = NSV 08841.
MU Ser = 493 = Nova Ser 1983 [304].
MV Ser = 508 = HR 6958 [131] = BD+3°3737 (6.7).
ST Sex = 253 = СПЗ 2671 [172].
SU Sex = 255 = СПЗ 2672 [172].
SV Sex = 257 = СПЗ 2673 [172].

SW Sex =259=PG 1012–029 [307].
SX Sex =261=СПЗ 2674 [172].
SY Sex =263=СПЗ 2556 [311].
V810 Tau =069=Hz 34 [312].
V811 Tau =070=Hz 625 [315].
V812 Tau =071=Hz 882 [315].
V813 Tau =072=Hz 879 [312].
V814 Tau =073=Hz 1124 [312].
V815 Tau =074=HII 1332 [317]=NSV 01295.
V816 Tau =075=Hz 3163 [315].
V817 Tau =076=33 Tau [131]=BD +22°607 (7.0).
V818 Tau =080=HD 27130 (G5) [320]=BD +16°577 (8.4).
V819 Tau =082=P1 [322]=WK X–Ray 1 [323].
V820 Tau =083=B1 [324].
V821 Tau =084=B2 [324].
V822 Tau =085=B8 [324].
V823 Tau =086=B7 [324].
V824 Tau =087=B4 [324].
V825 Tau =088=B10 [324].
V826 Tau =089=XR №1 [328].
V827 Tau =090=XR №2 [328].
V828 Tau =091=B3 [324].
V829 Tau =092=B9 [324].
V830 Tau =093=P4 [322]=WK X–Ray 2 [323].
V831 Tau =094=GR 269 [331]=ZB 33 [332]= =NSV 01647.
V832 Tau =095=B6 [324].
V833 Tau =096=BD +26°730 (8.3) [333,298].
V834 Tau =097=HD 29697 (K2) [337]=BD +20°802 (8.8).
V835 Tau =098=B5 [324].
V836 Tau =101=HV 6869 [338]=FK X–Ray3 [323]=NSV 01811.
QQ Tel =553=HR 7461 [245]=CoD −45°13354 (6.8).
UV Tri =027=var [339].
UW Tri =061=Nova? [342].
LR TrA =333=BV 776 [345]=CPD −65°3074 (8.2)=NSV 07100.
CH Tuc =006=S 6641 [347].
CI Tuc =010=S 6646 [347].
CK Tuc =641=S 6617 [347]=NSV 14598.
CL Tuc =643=S 6626 [347]=NSV 14678.
DV UMa =250=US 943 [351].
SS UMi =342=E 1551+718 [355].
ST UMi =559=СПЗ 2508 [356, *Горанский*].
SU UMi =633=СПЗ 2509 [356, *Горанский*].
IX Vel =225=CPD−48°1577 (8.5) [359]= =CoD−48°3636 (9.9).
IY Vel =241=CoD−44°4951 (6.9) [362].
IZ Vel =242=CoD−41°4720 (6.2) [362].
KK Vel =243=HD 78616 (B5) [364]= =NSV 04391.
KL Vel =244=HD 79416 (B8) [365]=CoD −43°5041 (6.7).
KM Vel =248=PK 274+2°1 [189].
KN Vel =251=HD 85037 (A0) [370]=CoD −49°4692 (7.1).
KO Vel =260=E 1013−477 [372].
KP Vel =262=V65 (NGC 3201) [373].
KQ Vel =277=HD 94660 (A0) [376]=CoD −41°6220 (6.4).
GW Vir =287=PG 1159–035 [377].
GX Vir =299=СПЗ 2675 [172].
GY Vir =300=СПЗ 2676 [172].
GZ Vir =302=HD 114842 (F8) [378]=BD −1°2786 (8.0).
HH Vir =303=СПЗ 2494 [379, *Горанский*].
HI Vir =304=СПЗ 2553 [380, *Горанский*].
HK Vir =305=СПЗ 2554 [380, *Горанский*].
HL Vir =306=СПЗ 2507 [381, *Горанский*].
HM Vir =307=СПЗ 2677 [172].
HN Vir =308=СПЗ 2495 [379, *Горанский*].
HO Vir =309=СПЗ 2496 [379, *Горанский*].
HP Vir =312=СПЗ 2555 [380, *Горанский*].
HQ Vir =313=СПЗ 2497 [379, *Горанский*].
HR Vir =314=СПЗ 2678 [172].
HS Vir =315=PG 1341–079 [308].
HT Vir =316=BD+5°2794 (7.3) [382].
ρ Vir =295=ρ Vir [384]=BD +11°2485 (5.2).
PW Vul =544=Nova Vul 1984 [386].
PX Vul =545=LHα 483–41 [389,390]= =NSV 12031.
PY Vul =551=G 185–32 [041].
PZ Vul =558=1548C858 [392].
QQ Vul =568=E 2003+225 [393].
QR Vul =571=BD+25°4165 (5.2) [382]= =HR 7739 [396].
QS Vul =572=22 Vul [397]=BD +23°3944 (5.5).
QT Vul =602=BD +23°4183 (9.5)=4 [269].

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LIGHT CURVE OF BV Dra

BV Dra, the brighter member of the interesting visual binary system ADS 9537, is an eclipsing binary of W UMa type.

Yamasaki (1979) observed the star in UBV between March 20, 1976 - May 16, 1977 and found some scatter in the composed light curve. He claimed that the origin of this scatter would be either the real scatter of the individual light curves or the hazy sky.

Geyer et al. (1982) did not report any light curve changes in the course of their UBV observations performed between 1976-1980. Their observed light curve was symmetrical.

Between August 1980 - May 1981 Rovithis and Rovithis-Livaniou (1982) made B and V observations of this star and found some scatter in the V light curve only.

BV Dra was observed in UBV colors on 3 nights (May 31, June 5, 8) in 1984 at Kottamia Observatory of the Helwan Institute for Astronomy and Geophysics. As comparison star BD + 61°1495 was chosen, its brightness and colors can be found in Table I of Geyer et al. (1981). The light curve is shown in the Figure. The magnitudes have been given in the instrumental system and the

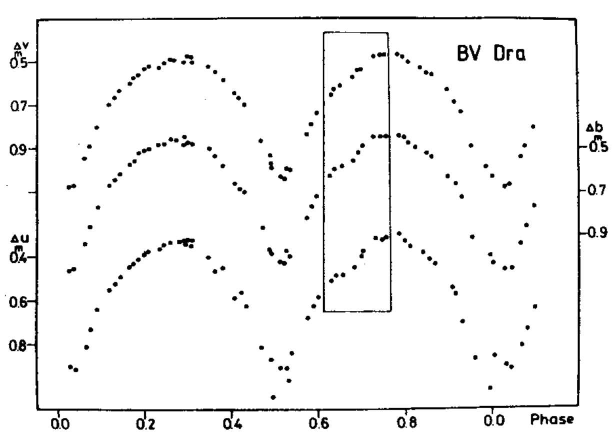

Figure 1

phases have been computed using Yamasaki's (1979) elements:

$$\text{phase} = \text{J.D. hel. } 2442858.06867 + 0.35006571 \text{ E}$$

One primary and one secondary minimum was obtained:

Min.I.: J.D. hel. 2445860.2392

Min.II.: J.D. hel. 2445857.2622

In the light curve between the phase 0.6–0.7 an interesting hump appeared (see the Figure). The amplitudes (A) of the hump in the light curves are different: $A(\Delta u)>A(\Delta b)>A(\Delta v)$.

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LIGHT VARIATION OF BW Dra

The W UMa type binary BW Dra is the fainter member of the visual binary system ADS 9537.

Yamasaki (1979) carried out UBV observations of this star between March 20, 1976 - May 16, 1977, and as in the case of BV Dra he found some scatter in the light curve, but gave no explanation for its origin.

During the years 1976-1980 Geyer et al. (1982) observed this star in BV and UBV systems. They found the light curve of BW Dra fairly symmetrical, with slight changes. The measurements of the individual nights have shown about $0\overset{m}{.}05$ deviations from the mean light curve at all phases. The depths of the minima were also variable.

In 1975 Rucinski and Kaluzny (1982) observed the star on 5 consecutive nights and found no light curve variation.

BW Dra was observed in UBV colours on 3 nights (May 31, June 5, 8) in 1984 at Kottamia Observatory of the Helwan Institute for Astronomy and Geophysics. As comparison star BD + $62^{o}1385$ was chosen (see Table I of Geyer et al., 1981). The light curve is displayed in Figure 1. Magnitudes have been given in the instrumental system and the phases have been calculated using the elements of Yamasaki (1979):

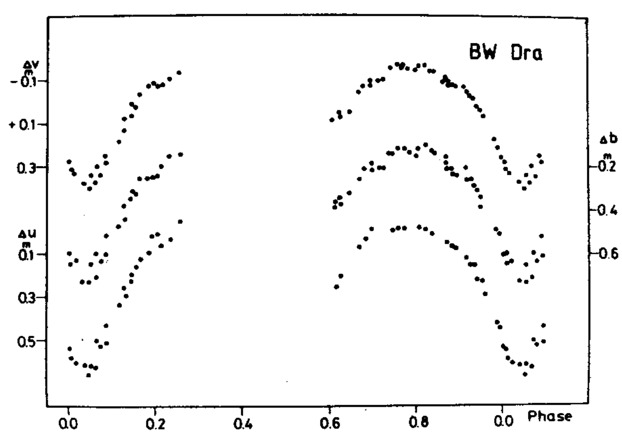

Figure 1

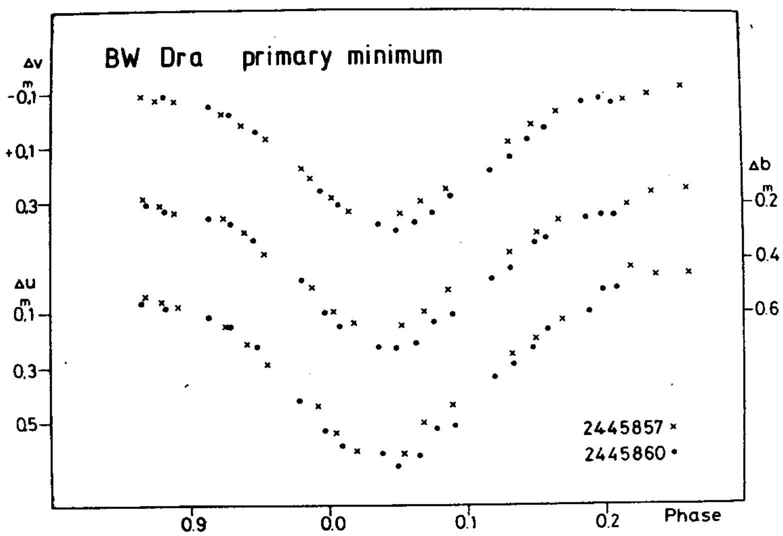

Figure 2

phase = J.D. hel. 2442858.27767 + 0.29216579 E

Unfortunately only primary minima were obtained:

Min I.: 2445857.3706
2445860.2946 (in Δb)
.2958 (in Δv)

The two primary minima are drawn in details in Figure 2. The observations made at 2445857 and 244 5860 running together until about 0.0 phase. After that the two light curves deviate from each other by about $0^m.06$–$0^m.08$ and produce minima of different depths. This behaviour of BW Dra was already noticed by Geyer et al. (1981).

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DISCOVERY OF VARIABILITY IN HR 9024

HR 9024 was placed on a list of bright suspected variable stars by Hall (1983) because the moderately strong Ca II H and K emission reported by Cowley and Bidelman (1979) suggested it might be an RS CVn-type binary and therefore variable as a result of starspot activity. Feldman (1982) has detected HR 9024 as a radio source and Bopp (1984) has obtained a spectrum which shows the H and K reversal clearly. The absence of detectable radial velocity variation by Feldman and the absence of detectable rotational broadening by Bopp prompted them to consider HR 9024 might be an FK Com-type star seen nearly pole-on. The spectral type is G1 III e .

We obtained UBV photometry on 154 different nights in 1982, 1983, and 1984 using HD 223848 as comparison star. Hopkins used an 8-inch telescope, Boyd a 10-inch. Most of the Boyd data have been published already (Boyd, Genet, Hall 1984ab, 1985); the Hopkins data and the latest Boyd data will be published later. The first five columns in Table I give the median epoch, the observer, the bandpass, the number of nights observed (m), and the number of mean differential magnitudes (n), for various groups of data. The Hopkins means include 1-to-4 individual differential measures; the Boyd means all include 3.

It was obvious even from the 1982 data that HR 9024 was variable, with a total amplitude of about $0^{m}_{\cdot}02$. For each group we determined the best period by making a series of least-squares sinusoidal fits and the uncertainty of each period by chi-squared analysis. These values are given in the sixth column of Table I. An average of the seven values suggests a period of P = $23^{d}_{\cdot}2 \pm 0^{d}_{\cdot}3$.

Then sinusoidal fits were made again using the same ephemeris

$$JD = 2,445,250.0 + 23^{d}_{\cdot}2\, n \qquad (1)$$

for all groups, the initial epoch in this equation being arbitrary. The last three columns of Table I show the resulting total amplitudes in magnitude units (Δm), the phase of minimum light (θ_{min}), and the rms deviation of a single point (σ_1). One of the light curves, based on Boyd's late-1984 V-band data, is shown in Figure 1 as an example.

TABLE I

Analysis of the Seven Data Groups

⟨JD⟩	Obsv.	λ	m	n	Period	Δ m	θ_{min}	σ_1
2,445,309	Hopkins	V	49	49	$24^{d}.6 \pm 0^{d}.4$	$0^{m}.020$	$0^{P}.427$	$\pm 0^{m}.007$
2,445,681	Boyd	V	64	83	23.6 ± 0.4	0.018	0.704	±0.008
2,445,681	Boyd	B	64	83	22.6 ± 0.4	0.019	0.723	±0.008
2,445,681	Boyd	U	64	83	22.4 ± 0.5	0.019	0.752	±0.009
2,446,018	Boyd	V	41	42	23.0 ± 0.5	0.036	0.591	±0.006
2,446,018	Boyd	B	41	42	22.6 ± 0.5	0.035	0.599	±0.007
2,446,018	Boyd	U	41	42	23.4 ± 0.6	0.041	0.612	±0.010

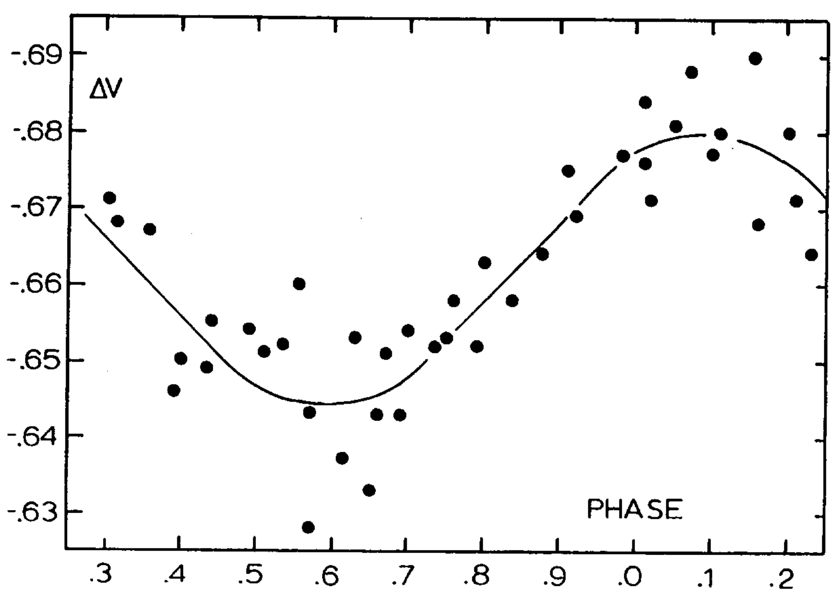

Figure 1

Light curve of HR 9024 based on Boyd's late-1984 V-band data. Phase is computed with the ephemeris in equation (1). The amplitude is $\Delta V = 0.036$ magnitude and minimum light falls at phase 0.59, as indicated in Table I. The rms deviation of the points from the curve is only ±0.006 magnitude.

To take advantage of the 2.2-year baseline in our photometry, we examined the seven θ_{min} values in Table I. A linear least-squares fit indicated an improved period of $23^d.25 \pm 0^d.09$. We considered the possibility of incorrect cycle count between the different groups, but the addition or subtraction of one count produced values of $21^d.7 \pm 0^d.1$ and $24^d.8 \pm 0^d.1$, both inconsistent with the value $23^d.2 \pm 0^d.3$ determined earlier by analysis of the different groups separately.

A representative epoch of minimum light, taken near the midpoint of the last group, would be JD 2446030.0 ± $0^d.5$. Therefore we suggest using the ephemeris

$$JD = \underset{\pm .5}{2,446,030.0} + \underset{\pm .09}{23^d.25}\, n \tag{2}$$

to predict future times of minimum light for HR 9024.

To convince ourselves that the variable is HR 9024 and not the comparison star HD 223848, we analyzed the 125 differential measures Boyd had made between that comparison star and his check star HD 400. Sinusoidal fits phased to correspond to the last six θ_{min} values in Table I all gave amplitudes which were zero within their uncertainties.

It is interesting to note that, between 1982 and 1984, HR 9024 has doubled its amplitude from around $0^m.02$ to around $0^m.04$. It will be interesting to see what happens to this trend.

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ADDITIONAL DOUBLE-LINED ECLIPSING BINARIES OBSERVED WITH CCD DETECTORS

High resolution coudé spectrometric observations have been made during the past six years as part of a continuing program to determine accurate absolute properties of eclipsing binary stars. Previous progress reports (Lacy and Evans 1979, Lacy 1984) have discussed 36 of the stars in this program. Observations of an additional 9 eclipsing binaries are discussed here. These observations were obtained with the 2.1 m reflector at Kitt Peak National Observatory (NOAO) and the coudé CCD spectrometer. Typically 100-200 Å in the blue (4500 Å) or red (6400 Å) were observed at a resolution of 0.3-0.4 Å. The individual binaries are discussed below:

Double-Lined Eclipsing Binaries

Name	Mag.	Spec.	P(days)	Name	Mag.	Spec.	P(days)
AD Boo	9.8	G0	2.06	V643 Ori	10.6	G-K	52.4
EY Cep	10.1	A5	5.52	V526 Sgr	9.7	A0	1.92
RT CrB	10.2	G0	5.12	FV Sco	7.9	early B	5.73
V885 Cyg	9.9	B9	1.69	BP Vul	10.1	A7	1.94
GM Hya	11.0	G2	12.19				

The listed data is generally as stated in the General Catalogue of Variable Stars (GCVS), except as noted below. Of the systems listed, only AB Boo and V526 Sgr have adequate multicolor photoelectric light curves. Photoelectric observers are encouraged to observe the other binaries in at least two well-calibrated colors in order to make possible the most accurate determinations of absolute stellar properties.

AD Boo: This star has moderately narrow double lines in the red. The line strength ratio is about 2:1. My spectra are consistent with the primary's G0 spectral type from the GCVS. Recently Sheng, Xian, and Tong (1983) obtained a good B,V lightcurve and found the period to be twice its older value. This is an important solar-type system.

EY Cep: Narrow double lines are seen in the blue with a line strength ratio of about 3:2. The late-A appearance of my spectra is consistent with the GCVS spectral type of A5.

RT CrB: Narrow double lines of nearly equal strength are observed in the 6400 Å region. The spectra are consistent with the G0 spectral type of the GCVS. Popper (1976) reports emission at the H and K lines and classifies the system as RS CVn type.

V885 Cyg: Broad double lines are seen in the blue with a line strength ratio of about 3 to 2. The appearance is consistent with the B9 spectral type.

GM Hya: Narrow double lines are seen in the red with about 5 to 1 line strength ratio. The spectra are consistent with a primary spectral type of G2.

V643 Ori: Narrow double lines are seen in the red with approximately equal line strengths. The spectra appear to be G-K, but a more precise estimate cannot be made from our observations. The color indices of Hilditch and Hill (1975) are very similar to those of YY Gem.

V526 Sgr: Broad double lines at 4481 Å MgII and 4549 Å TiII + FeII have approximately 3 to 2 line strength ratios. The spectra are consistent with A0. O'Connell (1967) has done a thorough photometric study of this eccentric system, including the determination of an accurate apsidal motion period.

FV Sco: A single observation appears to show broad double lines at 4481 Å MgII with 4 to 1 line strength ratio. The spectral type must be early B and cannot be as late as the B9 listed in the GCVS. HeI 4471 Å is very strong.

BP Vul: Narrow double lines in the blue have about 4 to 1 line strength ratios. The spectra are consistent with late A.

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HR 6384: A PROBABLE INTERACTING BINARY

Although little is known about this southern-hemisphere star, recent IUE spectra obtained by us show the characteristics of a close binary system containing substantial circumstellar gas. The only known spectral classification is M1-2 II-III + A (Houk and Cowley 1975). BV photometry quoted by Hoffleit (1982) gives V= 6.09, B-V= 1.78. No radial velocities are found in the literature.

The far-UV spectrum has very complex absorption and possible emission features. It resembles the spectra at some phases of the known interacting binaries SX Cas (Plavec, Weiland, and Koch 1982) and HD 207739 (Parsons, Holm, and Kondo 1983), and partial eclipses in the zeta Aurigae systems such as VV Cep (Hagen et al. 1980) and 22 Vul (Ake, Parsons, and Kondo 1984). Figure 1 suggests an embedded or obscurred secondary hotter than type A. In order to have substantial interaction between the components, the period of the binary is probably hundreds of days.

Ground-based photometric and spectroscopic observations are strongly urged. HR 6384 is the more southerly of a bright pair separated by 6 arcmin. The nearest comparison stars, designated by 59 and 58 on chart 161 of the AAVSO Variable Star Atlas, are HR 6438 (G8 Ib-II, V= 5.88, B-V= 1.07, U-B= 0.86) and HR 6442 (G8-K0 III, V= 5.80, B-V= 1.00) (data from Hoffleit 1982). Coordinates for 1985 (derived from SAO Catalog) :

HR 6384	(HD 155341, CPD-56 8098)	17h 12m 57.0s	-56° 52' 17"
HR 6438	(HD 156768, CPD-57 8478)	17h 21m 37.3s	-57° 59' 47"
HR 6442	(HD 156854, CPD-56 8191)	17h 21m 50.8s	-56° 30' 42"

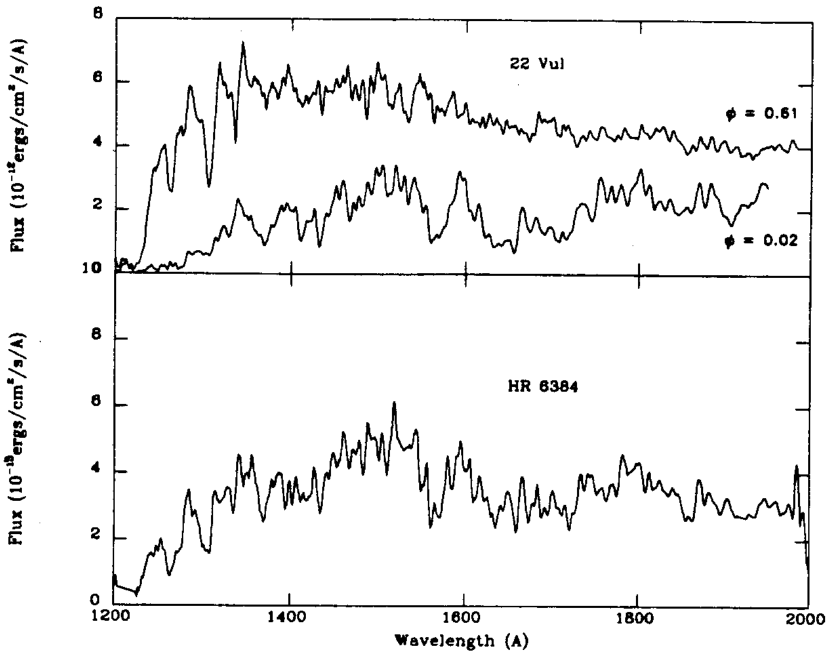

Fig. 1. IUE SWP spectrum of HR 6384 (bottom) and 22 Vul (top) at partial and out-of-eclipse phases. HR 6384 resembles 22 Vul at partial eclipse, where the added continuous and line absorption from the outer atmosphere of the G3 Ib-II primary strongly distorts the spectrum of the B9 secondary.

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CONFIRMATION OF THE 525 DAY PERIOD VARIABILITY FOR HD 2453

On the basis of the probable spectrum and magnetic variability suggested by Babcock (1958), photoelectric observations of HD 2453 were carried out at the stellar station of the Catania Astrophysical Observatory. The measurements were performed from 1970 through 1974 at a 30 cm telescope in the UBV natural system using the equipment described in Blanco et al. (1978). The comparison stars were HD 1439 (C1; HR 71 ; A1V) and HD 952 (C2; HR 44 ; A1V). A plot of the magnitude differences C1 - C2 did not show any variation. Magnitude differences between HD 2453 and the comparison stars have been cor.puted in each

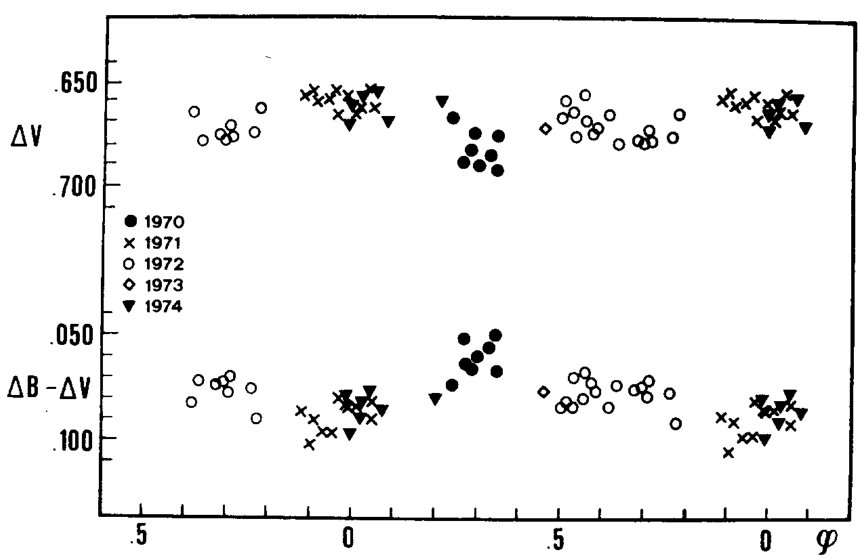

Figure 1. Light and colour variations of HD 2453 plotted vs. phase computed by means of formula (2). ΔV is Δm in V light computed by means of formula (1); Δ(B-V) is computed as ΔB - ΔV. Codes are as follows: ● 1970, x 1971, o 1972, ◇ 1973, ▼ 1974 .

colour by means of the formula:

$$\Delta m = \frac{1}{2}((Ap - C2) + (Ap - C1) + \langle C1 - C2 \rangle) \qquad (1)$$

where $\langle C1 - C2 \rangle$ is the annual average value of the magnitude differences between the comparison stars.

Search for variability on a time scale of months or shorter did not get results. The best representation of the observations is obtained by phasing them with the Wolff's 525 day period: we obtain light curves showing small amplitude variations in ΔV and even smaller in ΔB and ΔU. In Figure 1 the ΔV and $\Delta(B - V)$ variations are plotted versus the phase computed by means of the ephemeris (Wolff, 1975):

$$\text{J.D. (magnetic minimum)} = 2442\,288 + 525^{d} \cdot E \qquad (2)$$

It is evident from the Figure that the ΔV and $\Delta(B - V)$ variations are opposite in phase, the $\Delta(B - V)$ being in phase with the magnetic field intensity variation.

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VERIFICATION OF CEPHEIDS IN OPEN CLUSTERS
AND ASSOCIATIONS AS DISTANCE INDICATORS

The Cepheids, members of open clusters and associations, play important role as objects used for distance and absolute magnitude calibrations. Therefore it is interesting to note that four papers dealing with these stars: Fernie and McGonegal (1983, henceforth FM), Caldwell (1983), Stothers (1983) and Cester and Marsi (1984) differ from each other not only in methods of reduction but even in the selection of stars. The list of 29 stars given by FM is presented in Table I with the addition of four Cepheids: GU Nor, SX Vel, Y Sct, and X Cyg. These latter stars were included to the calibration Cepheids by Cester and Marsi but not by FM.

To provide an independent verification of these stars as distance indicators, the moduli $Mod_{FM} = (m-M)_o$ taken from FM paper have been compared with the similar values calculated from the new P—L—C relation for galactic field Cepheids, see Ciurla and Opolski (1984):

$$M_{\langle V\rangle} = \underset{\pm.81}{5.40}\langle B-V\rangle_o - \underset{\pm.84}{5.20}\log P - \underset{\pm.60}{3.44} \qquad \text{s.d.} = 0.29 \tag{1}$$

Assuming the ratio of total to selective absorption R = 3.20 we have:

$$E_{B-V} = \langle B-V\rangle - \langle B-V\rangle_o \tag{2}$$

$$\langle V\rangle_o = \langle V\rangle - 3.20(\langle B-V\rangle - \langle B-V\rangle_o) \tag{3}$$

and $$Mod_0 = \langle V\rangle_o - M_{\langle V\rangle}$$

or $$Mod_0 = \langle V\rangle - 5.40\langle B-V\rangle + 5.20\log P + 2.20\,E_{B-V} + 3.44 \tag{4}$$

For the present study the values of $\langle V\rangle$ and $\langle B-V\rangle$ have been taken from the catalogue of Schaltenbrand and Tammann (1971) and supplemented for five stars according to the references given by FM. These values are quoted in Table I with two decimal figures. The E_{B-V} values are given according to the papers by Dean et al. (1978) and Pel (1978) after reducing to the Dean's et al. system. In four cases when these quantities were missing, the Dean's et al. (1978) P-C relation has been applied to get $\langle B-V\rangle_o$ and E_{B-V}. These values are given in brackets. For four additional stars the reddenings E_{B-V}

Table I. Cepheids in open clusters and associations

Star	log P	⟨V⟩	⟨B-V⟩	E_{B-V}	Mod_0	Mod_{FM}	ΔMod
			reliable distance indicators, $\lvert \Delta Mod \rvert < 0.45$				
SU Cas	0.290	5.969	0.725	0.24	7.54	7.72	+0.18
EV Sct	.490	10.128	1.157	0.64	11.28	11.15	-0.13
GU Nor	.538	10.406	1.297	0.68	11.14	(11.11)	-0.03
CE Cas b	.651	10.988	1.140	(0.54)	12.85	12.85	0.00
CF Cas	.688	11.110	1.227	0.55	12.72	12.85	+0.13
CE Cas a	.711	10.919	1.213	(0.58)	12.79	12.85	+0.06
UY Per	.730	11.306	1.591	0.91	11.96	12.05	+0.09
CV Mon	.731	10.296	1.369	0.75	11.80	11.50	-0.30
VY Per	.743	11.193	1.644	1.00	11.82	12.05	+0.23
U Sgr	.829	6.714	1.142	0.43	9.25	9.21	-0.04
DL Cas	.903	8.942	1.216	0.51	11.64	11.35	-0.29
S Nor	0.989	6.414	0.969	0.22	10.26	9.95	-0.31
Y Sct	1.015	9.631	1.587	0.75	11.43	(11.28)	-0.15
TW Nor	.033	11.68	2.03	1.20	12.17	11.77	-0.40
VX Per	.037	9.300	1.242	0.49	12.51	12.06	-0.41
X Cyg	.214	6.395	1.213	0.23	10.10	(10.29)	+0.19
VY Car	.278	7.446	1.193	0.24	11.63	11.86	+0.23
RU Sct	.294	9.500	1.779	1.02	12.32	11.89	-0.43
RZ Vel	.310	7.114	1.209	0.32	11.55	11.52	-0.03
WZ Sgr	.339	8.018	1.455	0.43	11.52	11.26	-0.26
SW Vel	.371	8.126	1.252	0.38	12.78	12.38	-0.40
T Mon	.432	6.137	1.252	0.18	10.67	11.10	+0.43
RS Pup	.617	7.006	1.489	0.52	11.97	11.55	-0.42
SV Vul	.654	7.221	1.534	0.41	11.89	12.10	+0.21
GY Sge	.708	10.23	2.25	1.11	12.85	12.99	+0.14
S Vul	1.826	9.00	1.92	0.77	13.27	13.51	+0.24
			questionable distance indicators, $\lvert \Delta Mod \rvert > 0.60$				
V Cen	0.740	6.818	0.914	0.32	9.88	9.24	-0.64
CS Vel	0.771	11.70	1.37	0.68	13.26	11.95	-1.31
V367 Sct	0.799	11.578	1.700	(1.03)	12.26	11.49	-0.77
SX Vel	0.980	8.263	0.904	0.28	12.53	(11.60)	-0.93
SZ Cas	1.134	9.826	1.505	0.85	12.91	12.05	-0.86
KQ Sco	1.458	9.349	1.980	(0.99)	11.90	12.60	+0.70
V810 Cen	2.115	5.06	0.81	0.26	15.70	12.44	-3.26

according to Cester and Marsi (1984) have been adopted.

Table I contains also the moduli Mod_0 resulting from the formula (4) and FM moduli, Mod_{FM} . For four stars taken additionally from the paper by Cester and Marsi we have assumed as Mod_{FM} the values of $(m-M)_o$ given by these authors increased by 0.30, because there is a systematic difference about 0.30 between the moduli published in these two papers for the 23 common stars. In Table I these Mod_{FM} values are given in brackets.

The differences $\Delta Mod = Mod_{FM} - Mod_0$ are presented in the last column of Table I. From these values the following conclusion may be drawn:

1. In Table I there are 33 Cepheids proposed as distance indicators, but only for 26 ones, listed in the upper part of the Table the values $\lvert \Delta Mod \rvert$

are smaller than 0.45 . They can be explained as the result of uncertainties in cluster distances and as due to the limited accuracy of formula (4). Therefore these 26 stars should be recommended as reliable distance indicators. These stars determine the P - L relation given by FM and discussed by Ciurla and Opolski (1984).

2. The remaining seven stars in the lower part of Table I have $|\Delta \mathrm{Mod}|$ greater than 0.6 , which makes them questionable as distance indicators. Two of them, CS Vel and V 810 Cen, have been already omitted by FM in the investigation of the P - L relation. V Cen has been rejected by Stothers (1983) and SZ Cas by Caldwell (1983). The double mode Cepheid, V 367 Sct, has been discussed a number of times with conflicting conclusions. Also the membership of KQ Sco in the association may be questioned.

3. The distances of U Sgr and V Cen resulting from the moduli Mod_0 , Mod_{FM} and Mod_C , the latter from the paper by Caldwell (1983) can be compared with the distances published recently by Gieren (1984). His values were obtained by the surface brightness method:

	distances in pc	
	U Sgr	V Cen
from Mod_0	709	947
from Mod_{FM}	695	705
from Mod_C	673	689
Gieren	709	897

The consistency in the distance of U Sgr is confirmed in contrast with the differences in V Cen data, in accordance with the foregoing suggestion that the latter star belongs to the questionable distance indicators.

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PHOTOMETRIC VARIATIONS OF THE SUPERGIANT B3 Ia : HD 178129 *

The B and A supergiants are now known to exhibit semi-periodic photometric variations with semi-amplitudes up to 0.07 magnitude (Sterken, 1977). The semi-periods tend to increase with the absolute visual magnitudes (Sterken, 1977). Until now, to our knowledge, only 32 stars have known semi-periods and only 3 of them have spectral types comprised between B2 I and B8 I (Burki, 1978). So it is useful to complete this sample by more observations and to check whether the new observed supergiants share the properties already derived for this class of objects. In that context it is interesting to report the observations of the B3 Ia star HD 178129, though more data would be useful to better determine its semi-period.

Actually the detection of the photometric variations of HD 178129 is a by-product of observations obtained for another purpose and it is why its publication was delayed. Incidentally the B3 Ia star HD 178129 was used as one of the two comparison stars in a search for photometric variations of a mild Ap star HD 179761. At the time of our observations (1970), photometric variations were detected only for two B supergiant stars and no general trend was reported (Sterken, 1977). It turned out that the variations of the differential magnitude between the second comparison HD 178484 and HD 179761 is less than 0.02 m whereas it is as large as 0.1 m (in the *u* filter) between the supergiant and the second comparison.

The photometric observations were performed in Strömgren's *uvby* photometric system during nine nights from the 18th to the 26th of August 1970 at the ESO. We used the standard equipment at the 50 cm telescope. The sequence of the observations already described in Mégessier-Garnier (1972) was C_1-C_2-A_p-C_1-C_2-A_p-C_1, the recording time being 20 s in each filter. It was followed by a measurement of the sky in the four filters.

The main characteristics of the three stars are given in Table I and the journal of observations is given in Table II as well as the instrumental differential magnitudes in the four filters. The variation curves are represented in Fig. 1 where a free-hand curve is drawn to show the likely semi-period of the supergiant. The

* The observations have been performed at ESO, Chile.

Table I

star	spectral type	m_v	M_v
HD 178129	B3 Ia	7.41	-6.1
HD 178484	KO	6.56	
HD 179761	B8 III, A_p	5.15	

Table II

uvby instrumental differential magnitudes between HD 178129 and HD 178484.

date August 1970	JD 2 440 000 +	Δu	Δv	Δb	Δy
18	817.565	1.479	0.583	- 0.372	- 0.811
	817.587	1.489	0.586	- 0.376	- 0.816
19	818.533	1.494	0.598	- 0.347	- 0.795
	818.655	1.483	0.605	- 0.356	- 0.796
20	819.533	1.485	0.591	- 0.365	- 0.798
	819.555	1.489	0.593	- 0.370	- 0.803
21	820.522	1.450	0.564	- 0.400	- 0.832
	820.541	1.443	0.543	- 0.402	- 0.834
		1.467	0.549	- 0.402	- 0.837
22	821.527	1.422	0.531	- 0.421	- 0.857
	821.550	1.422	0.531	- 0.427	- 0.855
23	822.526	1.470	0.590	- 0.367	- 0.814
	822.545	1.477	0.584	- 0.381	- 0.811
26	825.531	1.526	0.611	- 0.339	- 0.776
	825.551	1.513	0.604	- 0.345	- 0.783
		1.517	0.627	- 0.332	- 0.773

instrumental differential magnitudes between HD 178484 and HD 179761 (Fig. 1, bottom) indicates the precision of the differential measurements. Their small variations ($\Delta m < 0.02$ m) during the observational period should be due to the A_p star variations.

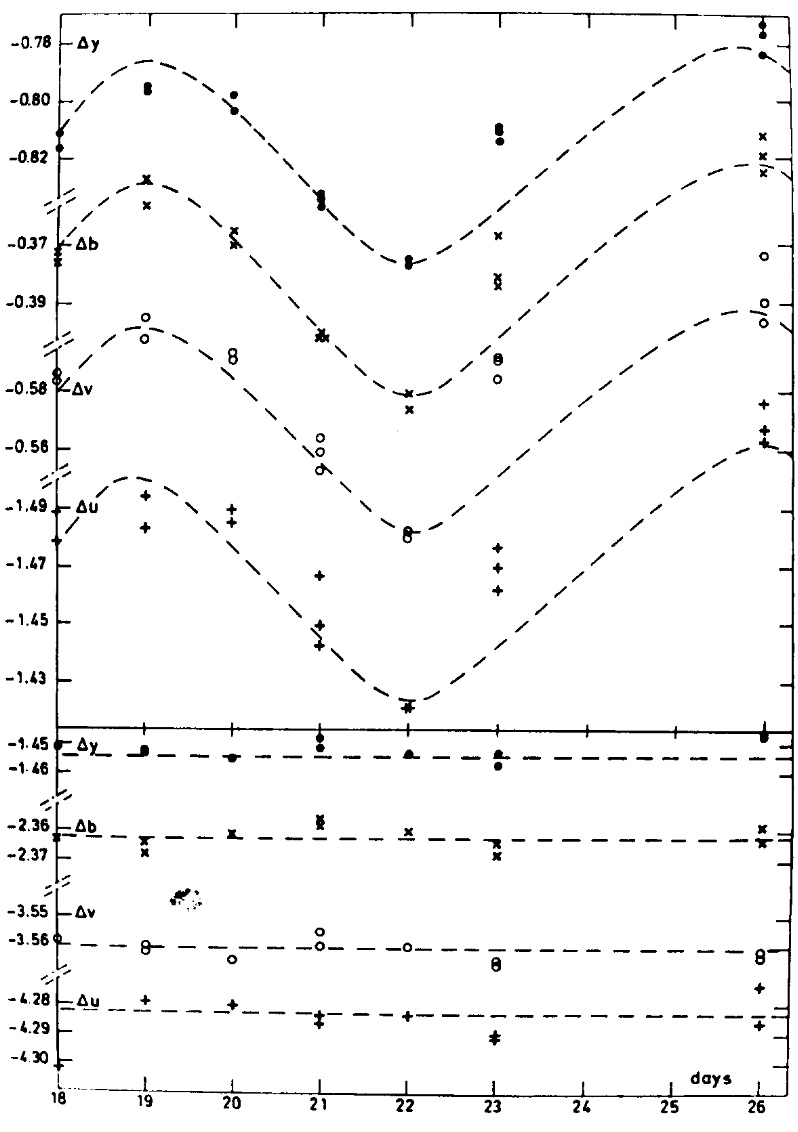

Figure 1. Top: Instrumental differential magnitudes between the supergiant HD 178129 and HD 178484;
Bottom: Instrumental differential magnitudes between HD 178484 and HD 179761

The amplitudes of the variations of the supergiant are of the same order of magnitude in the four filters ($\Delta y_{max} \simeq 0.08$, $\Delta v_{max} \simeq 0.08$, $\Delta b_{max} \simeq 0.09$, $\Delta u_{max} \simeq 0.10$ magnitude). More data are needed to determine the semi-period with some accuracy. Nevertheless these observations show that variations with some periodicity are certainly present and an order of the semi-period T may be eye-estimated. The free-hand curve in Fig. 1 corresponds to T = 7 days.

Since its absolute visual magnitude was determined by Hutchings (1971) (see Table I) we can place the representative point of HD 178129 in the M_V vs log T diagram given by Sterken (1977). It fits very well the general trend and it is the lowest point in the diagram. In the same way HD 178129 takes a logical place in both diagrams M_V / spectral type and M_V/log T given by Burki (1978). The half amplitude of the y variations $A(y)$ is about 0.04 which is in agreement with the general feature suggested by Sterken (1977), i.e. an increase of $A(y)$ with increasing luminosity.

We reported evident large photometric variations for the supergiant B3 Ia HD 178129. Although we have not a large number of measurements we can suggest a likely semi-period of the order of 7 days. If one adopts that semi-period the star shares the already derived properties for B supergiants. So, even if more observations are needed to confirm the semi-period, these facts support the estimated value.

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BD+37°2641, A POSSIBLE ECLIPSING BINARY SYSTEM

In 1982 we carried out a photometric study of the Delta Scuti star YZ Boo, aimed principally at determining its period of pulsation. Since the method of photometry followed was that of differential photoelectric photometry, the reference stars chosen satisfied the following conditions: Tha same apparent magnitude of the variable star and in its neighborhood, less than two degrees apart to minimize the effects of atmospheric extinction. Therefore, although most studies on YZ Boo utilized BD+37°2639 or BD+37°2634 as reference stars (Szeidl and Mahdy 1981) we chose BD+37°2640 as a reference and BD+37°2641 as a check star on the nights of 16-17 and 17-18 of April, 1982.

The use of at least one check star has been systematically considered in our observations since there is always the chance of utilizing a variable star as reference, thus making the obtention of the periodic content of the problem star impossible. Even more, the "quality" of the night can be directly measured by subtracting the two standard stars and evaluating their corresponding dispersion.

When this last procedure was done on the night of April 16-17 we obtained a σ of the difference of the two comparison stars, of 0.01 mag, but when the same evaluation was done on the following night, that of April 17-18, an exceedingly large scatter was obtained due, as can be seen in Figure 1, to the drop in the magnitude of the BD+37°2641 star.

Of course, when one finds a new variable or eclipsing star one cannot be sure of which star has changed, and the variation could be attributed to any of the observed stars. In this particular case, it is hard to believe that the change can be attributed to BD+37°2640 because both this and the variable star, YZ Boo, didn't change their magnitude so abruptly. Even more, on continuing the study of the variability of YZ Boo, it was observed this time utilizing not only BD+37°2640, but two more reference stars, mainly BD+37°2634 (which has also been extensively utilized as reference for YZ Boo) and a faint star, which has not been listed in the BD catalogue and that is located next to YZ Boo to the north of it; none of them changed their magnitude during four consecutive nights that were observed one month later from May 6, to 9, 1982, establishing the constancy of BD+37°2640.

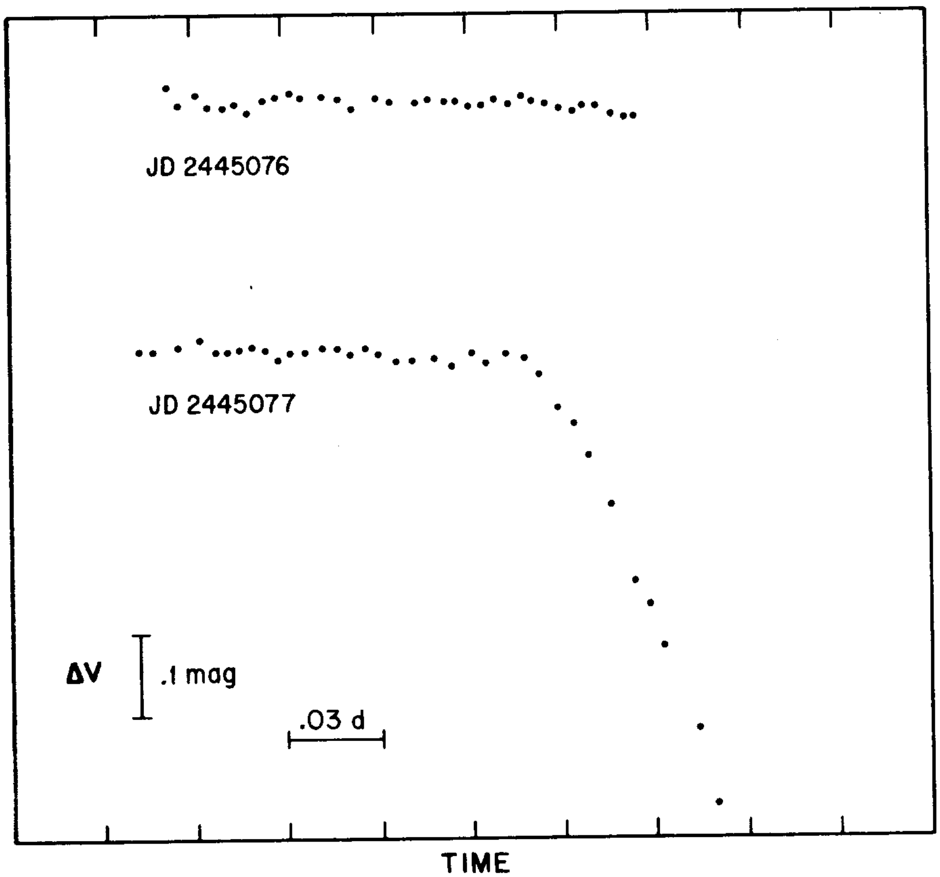

Figure 1 : Light curve of BD+37°2641. The upper part shows the difference between this star and BD+37°2640 on the night of April 17, 1982; the lower the same difference on the following night, April 18, 1982.

The observations were carried out using two telescopes. On the first night, April 17, they were carried out with the two-meter telescope whereas on the second one, April 18, the 1.5 m telescope was utilized. Both telescopes are at the Observatorio de San Pedro Mártir, México. In both cases a 1P21 cooled phototube was utilized in Johnson's V filter. Each point is an average of five ten-second integrations of the star minus one ten-second integration of the sky. Therefore, the accuracy of each point is of 0.003 mag and of 0.007^d in time. The difference in magnitude between BD+37°2641 and BD+37°2640 and the corresponding heliocentric Julian Days are listed in Table I.

One can see from the light curve of BD+37^{o}2641, Figure 1, that it experiences a drop in magnitude of at least 0.5 mag in a time span of about two hours, showing the characteristics of a binary system.

We plan and encourage further observations of this binary system which, as far as we know, has not been previously reported.

Table I : Photometry of BD+37^{o}2641 in the V filter

HEL JD 2445000.0+	D MAG	HEL JD 2445000.0+	D MAG
76.853	-0.215	77.747	-0.193
76.856	-0.192	77.755	-0.198
76.861	-0.205	77.762	-0.207
76.866	-0.190	77.768	-0.191
76.871	-0.188	77.771	-0.191
76.875	-0.192	77.775	-0.195
76.879	-0.182	77.780	-0.198
76.884	-0.195	77.784	-0.193
76.888	-0.201	77.788	-0.182
76.893	-0.205	77.792	-0.190
76.896	-0.200	77.797	-0.192
76.903	-0.201	77.803	-0.196
76.908	-0.198	77.807	-0.194
76.913	-0.185	77.812	-0.189
76.921	-0.199	77.816	-0.194
76.925	-0.195	77.821	-0.189
76.934	-0.193	77.827	-0.179
76.938	-0.197	77.832	-0.180
76.943	-0.195	77.839	-0.183
76.947	-0.195	77.845	-0.173
76.951	-0.188	77.851	-0.189
76.955	-0.190	77.856	-0.177
76.959	-0.197	77.863	-0.188
76.964	-0.191	77.869	-0.182
76.968	-0.201	77.873	-0.163
76.972	-0.195	77.879	-0.123
76.976	-0.192	77.884	-0.102
76.981	-0.186	77.889	-0.063
76.985	-0.182	77.896	-0.004
76.989	-0.188	77.904	0.088
76.993	-0.189	77.909	0.118
76.998	-0.179	77.914	0.168
77.002	-0.174	77.925	0.268
77.005	-0.175	77.930	0.359
77.742	-0.193		

We would like to thank the staff of the Observatorio de San Pedro Mártir, México, for the assistance provided, to D. Flores for the heliocentric correction evaluation, and to A. García for the drawing. J.A. Miller proofread the manuscript. The plots were carried out utilizing the Technical Report No 11 by J.F. Barral.

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HD 102077 - A NEW BY DRACONIS STAR? *

HD 102077 was proposed to be a southern RS CVn candidate by Weiler and Stencel (1979) on account of the strong emission in the H&K/CaII lines. Bopp and Hearnshaw (1983) found also the H_α absorption line nearly totally filled with an emission feature, confirming the outstanding chromospheric activity of this star. According to Houk and Cowley (1975) the spectral type of HD 102077 is KO/1 Vp.

HD 102077 was included in our photometric observing program of the southern chromospherically active stars. The discovery of its optical variability was recently reported by us (Udalski and Geyer, 1984). Here we present the full light and colour curves of HD 102077 obtained in 1984.

UBVRI photometry of HD 102077 was carried out during 10 nights between 14 and 24 April, 1984, at the European Southern Observatory - La Silla. The ESO 50 cm telescope, equipped with a single beam photometer and thermoelectrically cooled gallium-arsenide RCA 31034 photomultiplier, was used. The standard set of filters as described by Bessell (1979) approximates the standard UBVRI Cousins-Bessell system. HD 102076 served as the primary and HD 102202 as a secondary comparison star. Both stars turned out to be constant within $0^m.01$. The UBVRI-values of the comparison stars were obtained during 8 nights under the best sky conditions by observing up to 30 standard stars per night to derive the extinction-and the instrumental transformation coefficients. The relevant V-magnitudes and colours of the comparison stars are listed in Table I. The obtained standard errors for the single observations are $0^m.015$, $0^m.008$, $0^m.007$, $0^m.006$ and $0^m.005$ in the UBVRI colour bands, respectively. They include the error of observations and transformation to the standard system.

The variability of HD 102077 could be established beyond any doubt. During our observing run, the star changed its brightness in the range of $0^m.08$ in V band. We tried to derive the photometric period using the PDM ("phase dispersion minimization") method, described by Stellingwerf (1978).

* Based on observations collected at European Southern Observatory La Silla, Chile

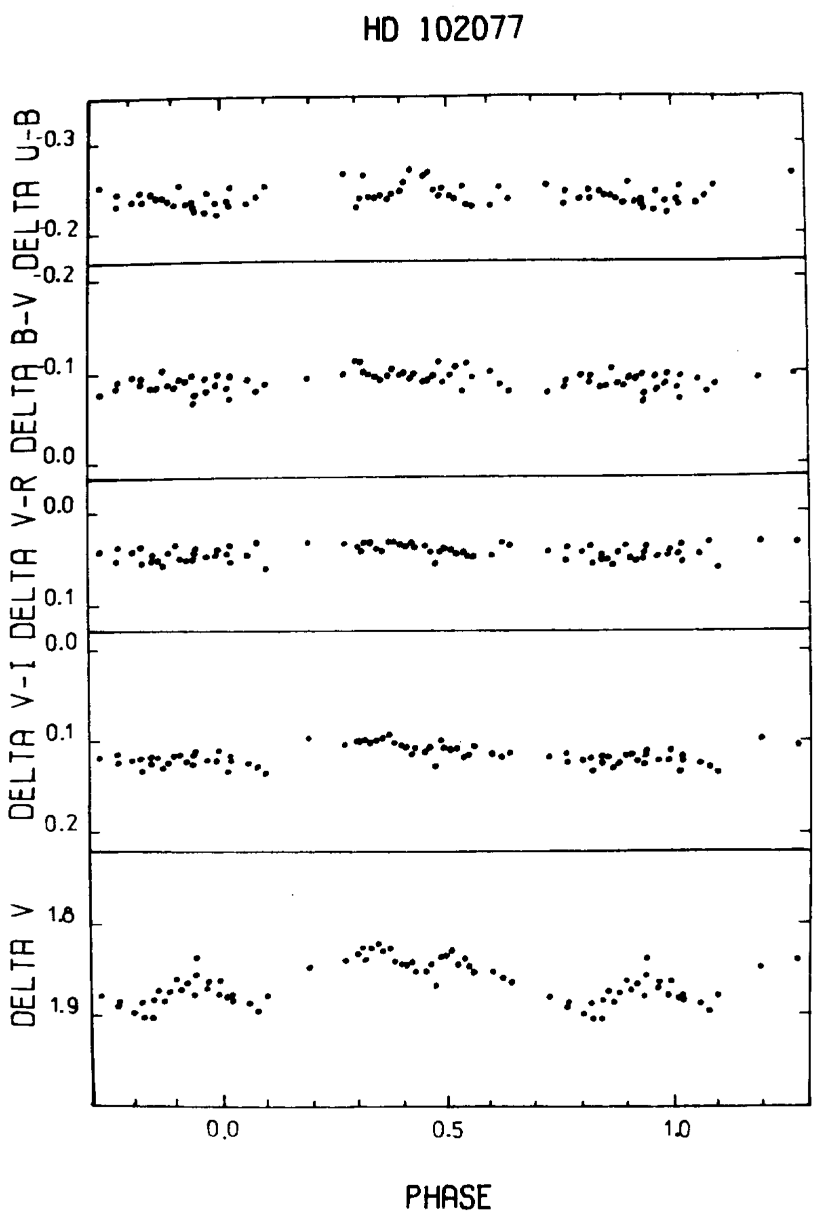
HD 102077
DELTA U-B
0.3
0.2
DELTA B-V
0.2
0.1
0.0
DELTA V-R
0.0
0.1
DELTA V-I
0.0
0.1
0.2
DELTA V
1.8
1.9
0.0
0.5
1.0
PHASE

Figure 1

Table I. V magnitudes and colours of the comparison stars for HD 102 077

Star	V	B–V	U–B	V–R	V–I
HD 102076	$7^m.110$	$1^m.004$	$0^m.751$	$0^m.514$	$0^m.971$
m.e.	.011	.006	.011	.005	.007
HD 102202	8.849	0.676	0.187	0.380	0.716
m.e.	.016	.008	.017	.007	.008

Table II. The average colours and V magnitudes of HD 102077 in 1984

	V	B–V	U–B	V–R	V–I
HD 102077	$8^m.97$	$0^m.91$	$0^m.51$	$0^m.56$	$1^m.09$

The light curve dispersion - period dependence resulting from the PDM method, yields two minima corresponding to periods $1^d.84$ and $2^d.2$ The accuracy of the thus derived periods is about 9% and is a consequence of the short duration of our run. We prefer rather $P=1^d.84$ as the photometric period because the V and colour curves seem to be smoother than with the $2^d.2$ trial period. Further observations will certainly solve this ambiguity.

Figure 1 shows the V and colour curves based on the light elements:

$$\text{J.D.hel.} = 2445805.4 + 1^d.84 \cdot E.$$

Here the initial epoch was chosen arbitrarily. The magnitude differences are given in the sense variable minus comparison star. The shape of the V light curve is somewhat complicated: there are two maxima - a broad one with some irregularities (light curve depression) around the phase 0.4 and a small secondary maximum at phase 0.95. The colour changes are marginal, and only in the V-I colour weak variations are noticeable. They seem to be correlated with the V luminosity, i.e. the star seems to be bluer during the broad maximum of light.

The late spectral type, the fast rotation, the complicated light curve shape and the correlation between the V magnitude and the V-I colour suggest that the photometric light variations are due to the presence of subluminous areas on the photosphere of HD 102077 being also the cause for the enhanced chromospheric activity of the object. Unfortunately, up to now there is no further information about the spectral behaviour of HD 102077 like radial velocity variations confirming the duplicity, or the presence of some lines which are charasterictic for spot activity. Therefore, it is not possible to classify properly HD 102077 among the chromospherically active stars. We believe, if the spectral classification for HD 102077 is correct to be a main sequence K0/1 dwarf (Houk and Cowley, 1975), HD 102077 fulfils the criteria for a BY Draconis type object of chromospherically active stars (Bopp and Fekel, 1977).

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UBVRI PHOTOMETRY OF THE SOUTHERN CHROMOSPHERICALLY ACTIVE STAR - HD 139084*

HD 139084 was listed by Bopp and Hearnshaw (1983) as one of the most chromospherically active southern stars. It shows strong H_α - line emission filling the absorption feature (Bopp and Hearnshaw, 1983). The H&K/CaII - lines are also in emission (Bidelman and MacConnell, 1973). The spectral type of HD 139084 is K1 III + F according to Houk and Cowley (1975). The discovery of its optical variability was recently reported by Udalski and Geyer (1984). In this paper we present the light - and colour curves of HD 139084.

UBVRI photometry of HD 139084 was carried out during 10 nights from 14 April, 1984 on, at the European Southern Observatory - La Silla. The ESO 50 cm telescope was used. It is equipped with single beam photometer, and a thermoelectrically cooled gallium-arsenide RCA 31034 photomultiplier. The standard Cousins-Bessell system is reproduced by the standard set of filters defined by Bessell (1979).

HD 139070 served as the primary comparison star and HD 139002 as a check star. Both comparison stars were constant during the observing run within $0^m.01$. The UBVRI-values of the comparison stars were obtained during 8 nights under the best weather conditions by observing up to at least 30 standards per night to tie in the comparison stars into the standard UBVRI system. The magnitudes and colours obtained in this manner are listed in Table I. The observations of HD 139084 were made differentially in the usual way, the differential magnitudes were corrected for differential extinction and transformed to the relevant system. The typical standard errors for the individual observations are $0^m.015$, $0^m.008$, $0^m.007$, $0^m.006$ and $0^m.005$ for UBVRI colours, respectively.

HD 139084 turned out to be photometrically variable. During our observing run the star changed its brightness within the range of $0^m.12$ in V. We tried to derive a photometric period of HD 139084 using the "phase dispersion minimization" method (PDM) described by Stellingwerf (1978).

* Based on observations collected at the European Southern Observatory, La Silla, Chile

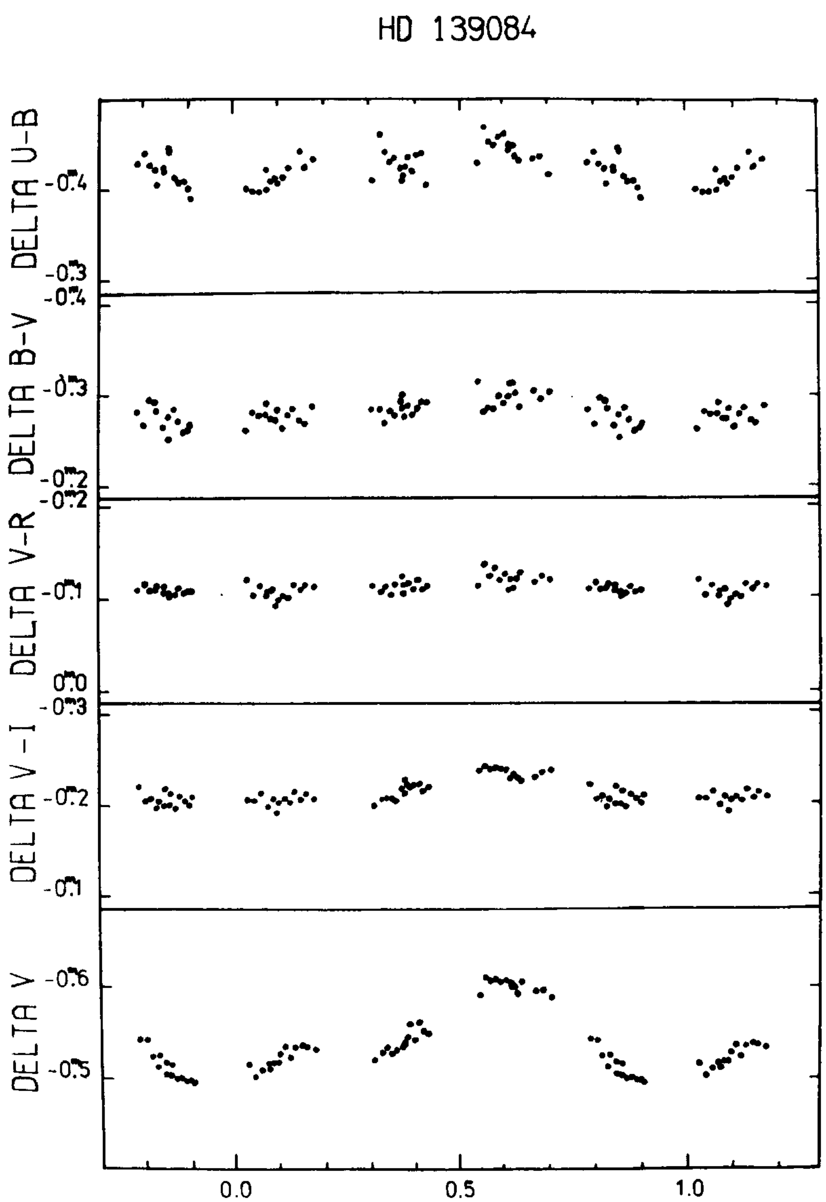
HD 139084
DELTA U-B
-0.4
-0.3
DELTA B-V
-0.4
-0.3
-0.2
DELTA V-R
-0.2
-0.1
0.0
DELTA V-I
-0.3
-0.2
-0.1
DELTA V
-0.6
-0.5
0.0
0.5
1.0

Figure 1

Table I. V magnitudes and colours of the comparison stars for HD 139 084

Star	V	B-V	U-B	V-R	V-I
HD 139 070	$8^m.681$	$1^m.113$	$0^m.796$	$0^m.593$	$1^m.153$
m.e.	.011	.009	.019	.006	.007
HD 139 002	8.270	1.750	2.013	1.001	2.181
m.e.	.014	.011	.030	.007	.008

Table II. The average colours and V magnitudes of HD 139 084 and the observed light and colour variation amplitudes in 1984

V	A_V	B-V	A_{B-V}	U-B	A_{U-B}	V-R	A_{V-R}	V-I	A_{V-I}
$8^m.14$	$0^m.12$	$0^m.83$	$0^m.06$	$0^m.38$	$0^m.07$	$0^m.48$	$0^m.04$	$0^m.94$	$0^m.06$

Table III. Minimum and maximum time instants of the 1984 light curve of HD 139 084 in J.D. hel.

Min. = 2445811.2 Max. = 2445813.8

The PDM method yielded $4^d.20$ for a photometric period. This result should be considered as preliminary, on account of the too short duration of our observing run, with the result that the PDM method yields an accuracy only about 20%. However, the visual inspection of the light and colour curves plotted with the light ephemeris:

$$\text{Min (J.D.hel.)} = 2445802.9 + 4^d.2\ E,$$

which is shown in Figure 1 , suggests that the period is determined fairly well. Yet further photometry is desirable for the object.

The mean V values and the colours of HD 139084 are listed in Table II while the time instants of the extreme values of the light curve are given in Table III. The magnitude and colour differences of Figure 1 have the sense "variable minus comparison". The V light curve is asymmetric with a small hump near the phase 0.15. The variations of all colour indices and their correlation with the V luminosity seem to be well established. Such a correlation, namely that the star is redder near the minimum light seems to be characteristic for chromospherically active stars. It suggests that dark and cool photospheric areas are responsible for light variations. Such an interpretation is most likely also for the HD 139084. The large amplitudes of colour indices indicate that the star is very "spotted" and active. The relatively large scatter of the (U-B)-colour curve could be caused by chromospheric Calcium plages appearing and disappearing at the stellar limb. Unfortunately the lack of spectroscopic observations does not allow to classify accurately HD 139084 among the chromospherically active stars. It seems most probable that HD 139084 is a member of the RS CVn group of chromospherically active stars, on account of its spectral type (Houk and Cowley, 1975). Yet spectroscopic rv-observations are essential for the proper classification of the star. If HD 139084 is indeed an RS CVn candidate, the spectroscopic period should be similar to the photometric period ($4^{d}.2$) due to almost synchronized rotation commonly observed in this class of stars.

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PHOTOELECTRIC TIMES OF MINIMUM LIGHT OF HI PUPPIS

The first photoelectric observations of HI Puppis (= CoD $-49^{\circ}2909$ = CPD $-49^{\circ}1276$ = S 4884) were obtained in January, 1981 with the 0.6-m telescope at Cerro Tololo Inter-American Observatory in Chile. Differential measurements in B and V were made on nine nights resulting in 780 individual observations in each bandpass. Each observation is an average of two ten second integrations.

The times of minimum light shown in Table I were determined by an iterative process using the method of Hertzsprung (1928). Photographic epochs of minimum light were previously obtained by Hoffmeister (1956).

The O-C values in Table I were computed from the ephemeris

$$\text{Min I (Hel. J.D.)} = \begin{array}{l} 2444609.7720 + 0.43256515\,E \\ \pm\, 0.0025 \;\pm\, 0.00000014 \quad \text{(p.e.)} \end{array}$$

which was derived by a least squares analysis utilizing the photoelectric and photographic data. The times of minimum were weighted 10 to 3, photoelectric to photographic.

The observations, period study, and analyses of the light curves are being published separately.

Table I. Times of minima for HI Pup

HEL. J.D.	MIN	EPOCH	O-C	FILTER
2444608.69007	II	-2.5	0.0005	B,V
2444609.77208	I	0.0	-0.0001	B,V
2444611.71909	II	4.5	-0.0006	B,V
2444614.74561	II	11.5	0.0009	B,V
2444616.69329	I	16.0	-0.0003	B,V

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HD 22403 : A NEW VARIABLE WITH Ca II H AND K EMISSION

HD 22403 (BD + 25°580) is a single-lined spectroscopic binary with strong Ca II H and K emission. The orbital period is ∿ 1.93 days and the spectral type of the visible component is close to G2V (Carquillat et al., 1979). This object was included in a photometric programme on late type emission binaries to search for the type of photometric variability exhibited by most of the binaries with G-K spectra with Ca II H and K emission.

Observations of HD 22 403 were made with the 34-cm Cassegrain reflector of the Kavalur Observatory on 18 nights through standard B and V filters during the period from 1980 November to 1981 February. All the measurements were made with respect to the comparison star HD 22 269 (BD + 27°529). As a check on the constancy of the comparison, HD 22 145 (BD + 26°572) was also observed on all the nights of variable star observation. The mean differential magnitude and colour of the comparison with respect to the check star (in the sense HD 22 145 - HD 22 269) obtained by us are $\Delta V = 1.010 \pm 0.003$ and $\Delta(B-V) = -0.801 \pm 0.002$.

The photometric data collected by us showed a scatter of ∿0.10 mag both in V and B indicating that HD 22 404 is definitely a variable. The Julian days of the observations were converted into orbital phases using the following ephemeris:

$$\text{J.D. } 244\,1926.590 + 1\overset{d}{.}9299395\,E \ ,$$

where the initial epoch corresponds to the time of the periastron passage and the period is the spectroscopic orbital period (Carquillat et al., 1979). The differential magnitude and colour (in the sense HD 22 403 - HD 22 269) are plotted against the orbital phases thus computed in Figure 1. Each point is an average of 3-4 independent observations. The probable errors of the differential magnitude and colour are 0.012 and 0.010, respectively. Even though the observations are spread over about 47 orbital periods, the data obtained define a coherent light curve with little scatter. This implies that the photometric period is either equal or very close to that of the binary orbital period. As seen in Figure 1 the light curve is very asymmetric and the total

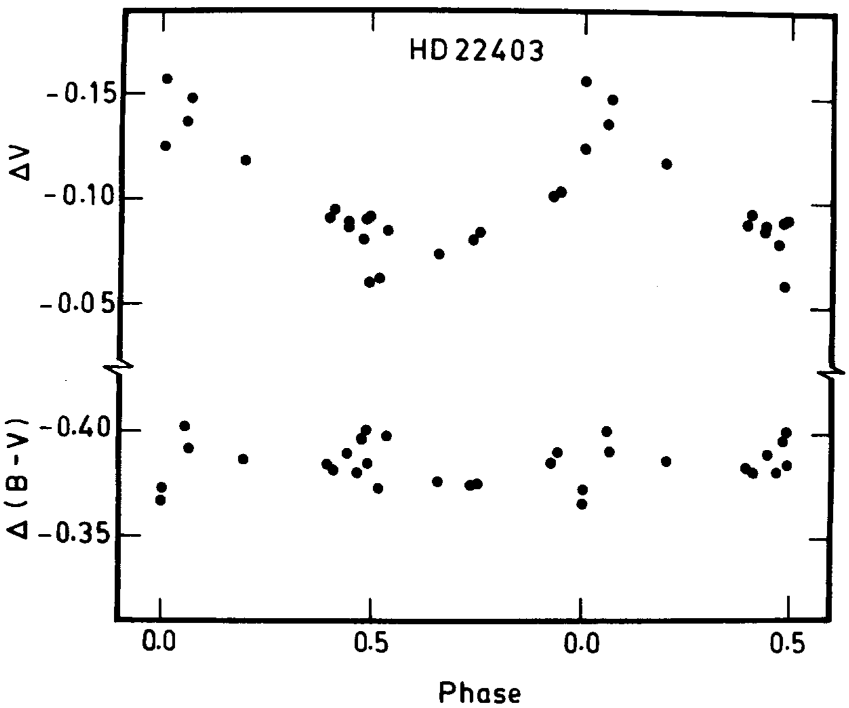

Figure 1

amplitude in V is ∼0.09 mag. The Δ(B-V) values do not show any significant correlation with the light variation but appear scattered about the mean Δ(B-V) = -0.384 ± 0.002 . From our photometric data we derived a mean (B-V) = 0.70 ± 0.01 for HD 22 403, consistent with the spectral type G2V assigned to it by Carquillat et al. (1979).

The nature of the light curve rules out geometrical eclipses as the cause of the observed light variation. Probably, in HD 22 403 we are seeing the type of 'activity' exhibited by the well known RS Canum Venaticorum and BY Draconis variables, where the photometric variation is attributed to the presence of 'starspots' which rotationally modulate the observed flux.

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NOTE ABOUT THE VARIABILITY OF HD 23 838

In IBVS No.2654 P. Vivekananda Rao et al. report on the probably very slight or non-variability of HD 23 838 = HR 1176 . While their conclusion appears correct for the limited data available, it should be pointed out that the comparison star used, HD 23 728 = HR 1170 , is a known Delta Scuti type variable, V 376 Per, 5.8 - 5.91 V , periods 0.097 and 0.067 d. Thus the small amplitude variations of about 0.05 V shown in Figure 1 (unless they are indeed purely observational errors) may be a combination of the variability of both HD 23 728 and HD 23 838. Small wonder that Δm(var-comp) and Δm(check-comp) show the same mean scatter of ±0.02 . It would have been of interest to see a companion figure for Δm(check-comp).

Although no real variation of HD 23 838 is apparent from these observations, they are not sufficiently numerous to rule out an eclipsing type of variability, especially as no SB period is available for guidance.

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HR 1362: A CHROMOSPHERICALLY ACTIVE VARIABLE WITH A 5-MONTH PERIOD

The bright ($V = 6^m.3$) star HR 1362 = HD 27536 was put on a list of suspected variables (Hall 1983) because it had appeared in a table of stars showing Ca II H and K emission (Bidelman and MacConnell 1973). Although they had noted the emission as "uncertain", Walter and Bowyer (1981) later detected x-ray emission, another signature of the chromospherically active stars. The spectral type was given as G8 IV by Bidelman and MacConnell (1973) and as G8 IV: by Cowley and Bidelman (1979). The absolute magnitude of $M_V = 0^m.65$ given by Eggen (1978), however, is even brighter than that typical for a G8 III star (Allen 1963), so we might question the subgiant classification. Five photoelectric measures of HR 1362 by Lake (1964) showed a range of $0^m.07$ in V, $0^m.05$ in B-V, and $0^m.04$ in U_c-B.

Between December 1979 and December 1984 six observers used seven different telescopes to obtain 140 mean differential magnitudes on 121 nights. Most were made in all three bandpasses of the UBV system and all used HR 1332 = HD 27179 as the comparison star. See Table I. Each mean includes 2-to-4 individual measures between variable and comparison, corrected for differential atmospheric extinction and transformed differentially to the UBV system. Most of the Boyd data have been published already (Boyd, Genet, Hall 1984, 1985); the rest will be published later.

It is clear from Figure 1 that HR 1362 is variable with a long period. Because parts of the light curve are missing, we tried several different techniques to estimate the period: comparison of times at corresponding levels on the rising branch, comparison of the two relatively well defined minima at JD 2445690 and 2445995, determination of the period which gives the smallest residuals and largest amplitude after a Fourier fit by least squares, and application of the period-finding algorithm of Lafler and Kinman (1965). All the techniques gave values between 152 and 156 days, with an average of P = 154 days. For that reason the break in the abscissa of Figure 1 has been made exactly 154 days, so the probable shape of the light curve can be apparent. It seems we have covered 3/4 of a complete cycle, with only the maximum and top half of the falling branch absent.

TABLE I

Tally of Observations

Observer	Observatory	Location	Telescope	Nights	Means	λ
Boyd	Fairborn	Arizona	10-inch	86	105	VBU
Barksdale	Barksdale	Florida	14-inch	13	13	V
Fried	Braeside	Colorado	16-inch	2	2	VBU
Henry	Dyer	Tennessee	24-inch	1	1	V
Henry	Kitt Peak	Arizona	16-inch	13	13	VB
Pearsall	Beech Hill	Tennessee	8-inch	4	4	V
Wasson	Sunset Hills	California	8-inch	2	2	V

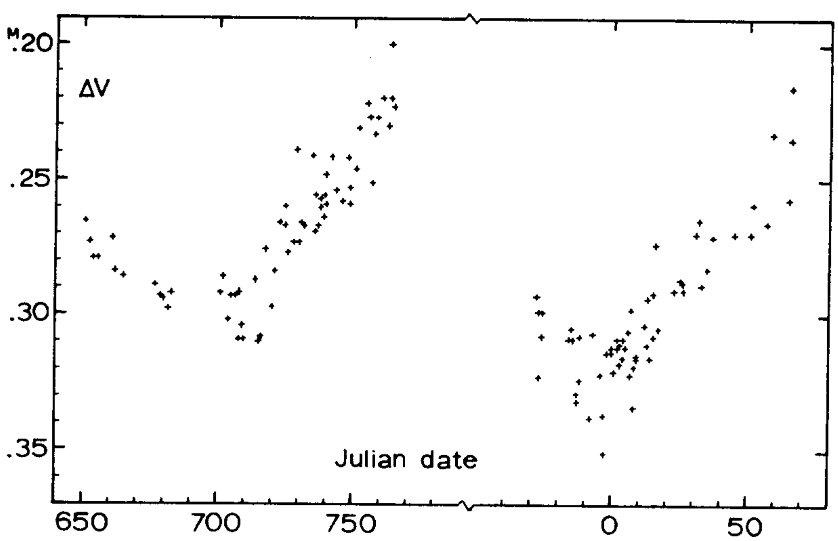

Figure 1

The 1983 and 1984 light curve of HR 1362 in V, where Δ is in the sense variable minus comparison. The amplitude is 0.10 magnitude, or more if the very top has not been reached. The abscissa is Julian date with 2445000 subtracted from the left side and 2446000 from the right; the break is exactly one cycle of the 154-day period.

We suggest

$$JD = 2445995 + 154^{d}\ n \qquad (1)$$

as an approximate ephemeris for predicting times of minimum light. The total amplitude is $0\overset{m}{.}10$ in V, or perhaps a bit more. Linear regression analysis indicates the amplitudes in the three bandpasses are in the ratios

$$\Delta V\ /\ \Delta B\ /\ \Delta U = 1.00\ /\ \underset{\pm.04}{1.21}\ /\ \underset{\pm.07}{1.52}\ , \qquad (2)$$

telling us that HR 1362 does change significantly in color as it varies in brightness, consistent with what Lake (1964) had found.

Differential measures between the comparison star and a check star, made on the 86 nights when Boyd observed HR 1362, showed no trace of a $0\overset{m}{.}10$ variability with a 154-day periodicity, thus demonstrating that HR 1362 really is the variable. The 1982 edition of the Yale Bright Star Catalogue does list Boyd's check star (ξ Eri = HR 1383) as a suspected variable, possibly of the delta Scuti type. His check-minus-comparison measures may reflect a small variation but, having been made only once each night, are not able to define the light curve of a short-period delta Scuti-type variable.

To our knowledge this 154-day period is considerably longer than for any other known chromospherically active variable. Until now the longest were $71\overset{d}{.}7$ for 93 Leo, $77\overset{d}{.}65$ for 39 AY Cet, and $82\overset{d}{.}8$ for 12 BM Cam. At this point we cannot call HR 1362 a long-period RS CVn binary because there is no evidence of duplicity: a composite spectrum, double lines, or radial velocity variations. This new variable, of potential interest for a number of reasons, deserves more attention.

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THE SYMBIOTIC STAR AG PEGASI: UBV PHOTOMETRY DURING 1962 - 1984

AG Peg is one of the brightest and most studied symbiotic stars. It is known that its brightness increased by 3^m from 1840 to 1860 with a subsequent slow decrease (Rigollet, 1947). It is being continued now at a rate $\Delta m_{pg} \approx 0^m.04$/yr (Meinunger, 1983). The increase of brightness in 1946 noted by Rigollet (1947) has been caused by light fluctuations appeared around 1935 (Meinunger, 1983).

UBV photometry of AG Peg was resumed at the Crimean Astrophysical Observatory in 1980 (Belyakina, 1970). The results of our observations (•) are shown in the Figure together with Burchi's 1980 (Δ), Fernie's 1972 (o), and Meinunger's 1983 (x) results.

Evidently, the V, B, U light curves resemble each other and are in fact undulated fluctuations in combination with a general decrease ($\Delta V \approx 0^m.02$/yr, $\Delta B \approx 0^m.04$/yr, $\Delta U \approx 0^m.045$/yr). The amplitudes of these fluctuations increase noticeably in time. But they tend to be constant in the intensity scale with ratio $I_V : I_B : I_U = 0.8 : 1.0 : 0.8$. The 1984 observations were not used for this calculation.

Some values (800^d , 827^d) have been assumed or derived for the light fluctuation period of AG Peg (Belyakina, 1970 , Meinunger, 1983). In the last few years different values (733^d, 760^d) were obtained from the visual observations of this variable (Slovak, 1982; Luthardt, 1984).

Figure 1 shows moments of the light curve minima indicated by vertical lines according to:

$$\text{Min.} = \text{J.D. } 24\,39\,000 + 820^d E \quad .$$

This value fits the light curve apparently well. But the minimum of the V light curve in 1983 is displaced. Possibly that was the reason why the period values derived by Slovak (1982) and Luthardt (1984) are shorter.

The IR photometry has demonstrated that the red component of AG Peg binary system is constant (Glass et al., 1973; Feast et al., 1977; Mendoza, 1972).

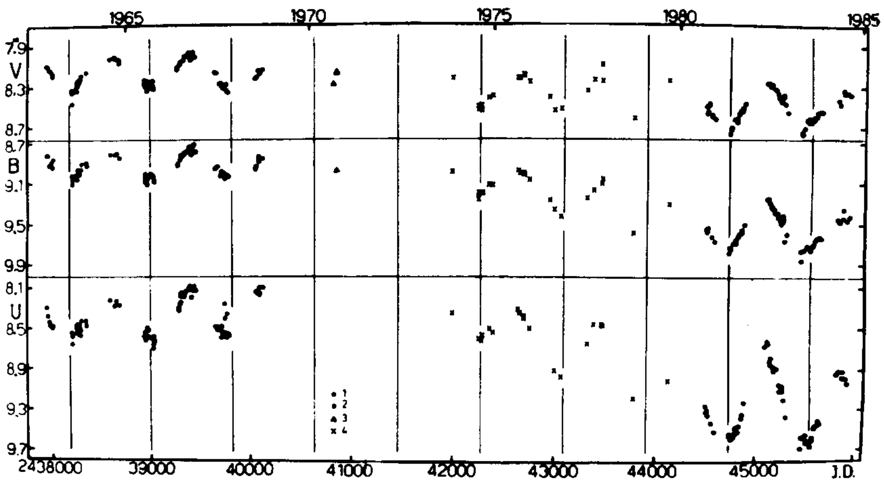

Figure 1

Probably the light fluctuations of AG Peg are caused by the orbital motion of the components. It follows from the correlation of the light curve and radial velocity curve of this variable star.

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THE SYMBIOTIC STAR Z ANDROMEDAE: UBV PHOTOMETRY DURING 1974 - 1984

Z And is one of the best known symbiotic stars. Its light curve is an alternation from the periods of enhanced activity ($\Delta m_{pg} \approx 2^m - 4^m$) to relative quietness ($\Delta m_{pg} < 1^m$) (Mayall, 1969; Mattei, 1978).

UBV photometry of Z And has been resumed at the Crimean Astrophysical Observatory since 1981 (Belyakina, 1970).

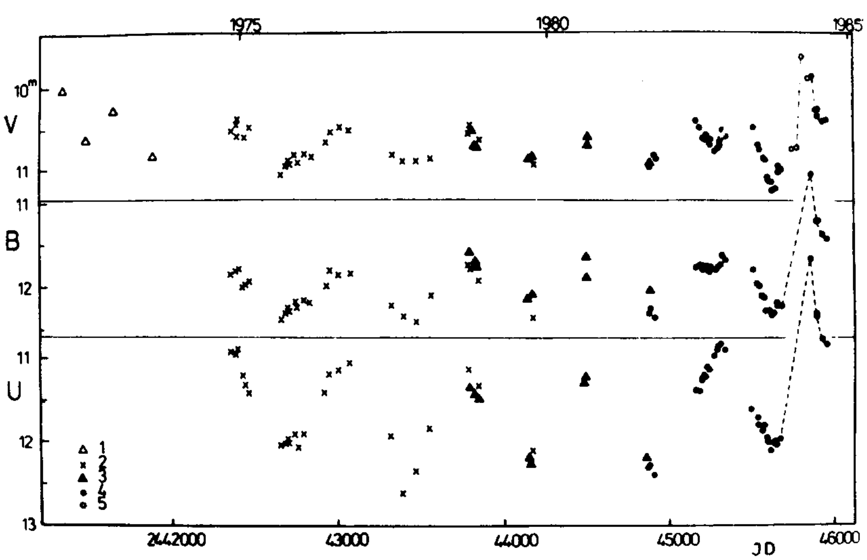

Figure 1

This variable was in quiet state from 1974 till 1984. The results of Meinunger's (1981) (x), Yudin's (1982) (▲) and our (•) UBV measurements carried out in this period are presented in Figure 1. Some visual brightness estimations of this star are also demonstrated here (Δ,o) (Mattei, 1978, 1984; Morgan, 1984). The V, B, U light curves show simultaneous fluctuations with the quasi-period equal to 700^d and their amplitudes are close to $0^m.5$, $0^m.6$ and $1^m.3$, respectively.

The observations of Z And being scanty do not permit us to make a detailed analysis of these light curves. But the shapes of the U and V light curves in the 1975 minimum and the 1982 maximum are obviously different. It can be explained within the framework of a binary model where the red component shows small variations. The IR photometry confirmed this hypothesis (Yudin, 1982).

The 1983 minimum in the V light curve is deeper and the corresponding U light curve is shallower than the preceding ones. It might be caused by the appearance of the 1984 outburst (Mattei, 1984).

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NSV 6044: A W UMa STAR

During April 1984 a number of suspected variables were observed with the Danish 50cm telescope on Cerro La Silla, Chile. Among these was NSV 6044, the variability of which was originally discovered by Hoffmeister (1949) who designated it S4963 Cen and classified it as an Algol type variable of magnitude 9-10. The spectral type given by Houk (1982) is G5V.

NSV 6044 was observed seven nights during a period of generally poor photometric quality. Nevertheless, the data can be used to obtain an ephemeris and, as the figure shows, they provide ample information on the general shape of the lightcurve, though it must be emphasized that the data are neither sufficiently numerous nor of adequate quality to justify a proper lightcurve analysis.

Information on the two comparison stars used, including their uvby indices on the standard system, is listed in Table I. There is no indication of variability of the comparison stars. For the variable, average values of the indices are given in Table I and individual magnitude differences in Table II. u magnitudes have been omitted because their typical mean errors are larger than 0.01 mag and twice as large as those for y, b, and v.

One time of minimum light could be determined by the method of Kwee and van Woerden (1956). The period was found by using the period analysis program of Jørgensen and Gyldenkerne (1975). The resulting ephemeris is:

$$\text{Min I:}\quad \text{HJD } \underset{\pm 1}{2445805.7721} + \underset{\pm 1}{0\overset{d}{.}33092}\ E$$

The indices of NSV 6044 show only small variation with phase, and the mean values in the instrumental system are well

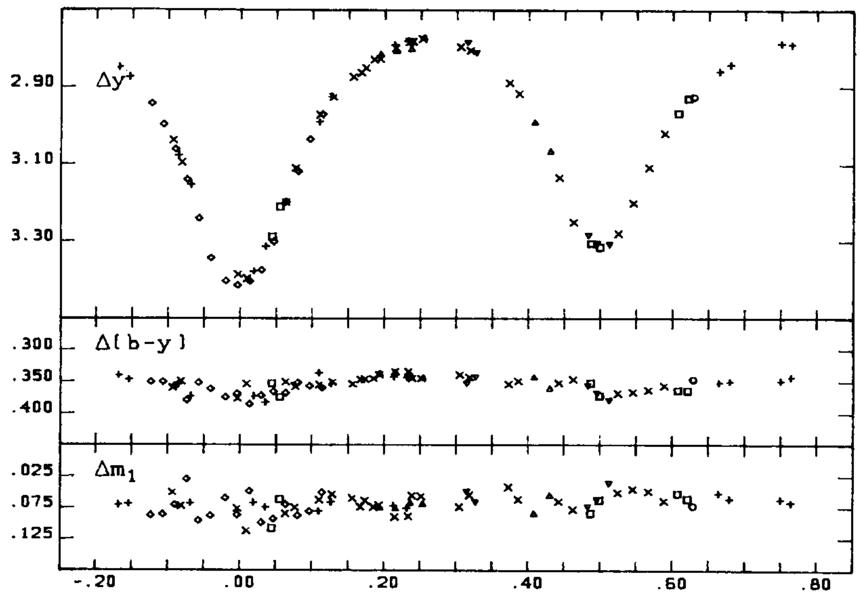

Figure 1

determined. Thus, the dominant contribution to the mean errors comes from the transformation. Mean errors are: $\sigma(b-y)$ = 0.009, $\sigma(m_1)$ = 0.008, and $\sigma(c_1)$ = 0.015.

TABLE I

	Comparison 1	Comparison 2	Variable
HD number	112563	110653	112669
HR number	-	4838	-
Spectral type	A3V	B8/9V	G5V
No of obs.	92	51	75
V	6.724	6.394	9.51-10.13
b-y	0.071	-0.009	0.433
m_1	0.160	0.095	0.210
c_1	1.124	0.872	0.296

Physical parameters for NSV 6044 can be estimated following the approach of Rucinski (1983) and making use of the transformations derived by Olsen (1984). This leads to a combined absolute magnitude of 3.9 and a distance of 150 pc, a reddening E(b-y) = 0.029, reddening corrected indices of $(b-y)_o$ = 0.404, $(m_1)_o$ = 0.219, $(c_1)_o$ = 0.290, δm_1 = 0.004, δc_1 = 0.011, individual absolute magnitudes (assuming identical components) of 4.7 ± 0.1, T(eff) = 5700 K ± 100 K, [Fe/H] = -0.05 ± 0.08, log g =

TABLE II: magnitude differences HD 112563 - NSV 6044 in the instrumental system

HJD-2445000	y	b	v	HJD-2445000	y	b	v
798.69705	2.945	3.298	3.713	801.80005	3.386	3.763	4.217
798.70014	2.925	3.271	3.689	801.80423	3.397	3.751	4.217
799.64595	3.305	3.657	4.093	801.82216	3.199	3.550	3.986
799.65002	3.315	3.687	4.122	801.82649	3.110	3.468	3.901
799.68587	2.967	3.330	3.745	801.85282	2.874	3.228	3.642
799.69044	2.929	3.293	3.718	801.85862	2.851	3.197	3.607
799.83024	3.289	3.642	4.103	801.86513	2.827	3.166	3.576
799.83396	3.211	3.586	4.023	801.87241	2.799	3.133	3.557
800.69746	2.859	3.210	3.613	801.87854	2.783	3.117	3.540
800.70237	2.841	3.190	3.600	803.59088	2.992	3.335	3.763
800.72562	2.786	3.134	3.544	803.59816	3.067	3.428	3.845
800.73053	2.789	3.131	3.540	803.85083	2.816	3.154	3.568
800.75259	2.849	3.189	3.600	803.85812	2.807	3.143	3.556
800.75736	2.874	3.221	3.637	803.86494	2.802	3.145	3.556
800.78011	3.077	3.432	3.860	803.87068	2.773	3.117	3.531
800.78570	3.153	3.526	3.967	805.73124	2.943	3.294	3.733
800.81463	3.378	3.751	4.191	805.73677	2.997	3.348	3.785
800.82012	3.314	3.697	4.155	805.74230	3.062	3.419	3.847
800.84468	2.990	3.326	3.743	805.74766	3.141	3.521	3.931
800.85036	2.924	3.277	3.696	805.75309	3.241	3.593	4.041
800.87906	2.791	3.133	3.547	805.75865	3.344	3.706	4.156
800.88514	2.780	3.123	3.542	805.76543	3.403	3.778	4.213
801.50670	2.972	3.327	3.745	805.77088	3.415	3.784	4.240
801.51273	2.926	3.277	3.682	805.77650	3.404	3.790	4.225
801.52561	2.863	3.210	3.631	805.78193	3.375	3.747	4.218
801.53155	2.829	3.174	3.593	805.78746	3.302	3.668	4.127
801.54930	2.782	3.127	3.528	805.79309	3.198	3.566	4.004
801.55358	2.775	3.120	3.522	805.79865	3.119	3.471	3.911
801.57114	2.796	3.135	3.548	805.80403	3.036	3.393	3.831
801.57567	2.805	3.148	3.546	805.80979	2.970	3.330	3.741
801.59371	2.889	3.243	3.639	809.51628	2.783	3.135	3.535
801.59819	2.917	3.266	3.677	809.52034	2.809	3.150	3.556
801.61674	3.134	3.486	3.903	809.57204	3.282	3.637	4.064
801.62339	3.250	3.596	4.020	809.57614	3.303	3.670	4.098
801.64395	3.279	3.647	4.066	809.58172	3.306	3.684	4.097
801.65081	3.200	3.566	3.977				
801.65790	3.107	3.470	3.882				
801.66513	3.019	3.375	3.795				
801.77024	3.038	3.398	3.809				
801.77423	3.096	3.446	3.869				

4.46 ± 0.06 (cgs). All these values are in good agreement with what one would expect for a G5V star, with the possible exception of M_V which is 0.4 mag too bright.

In conclusion, NSV 6044 is in all probability a W type W UMa variable of normal metal content and only slightly evolved away from the ZAMS (ΔM_V = 0.14 mag).

Due to the relative faintness and short period of NSV 6044 no further observations with the Danish 50 cm telescope are planned.

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SPECTROSCOPIC OBSERVATIONS OF NOVA VULPECULAE 1984 NO. 1

Spectroscopic observations of Nova Vul 1984 No. 1 have been obtained with the McGraw-Hill Observatory 1.3 meter telescope. These data were taken using the intensified reticon scanner. Two scans in the blue were obtained on 1984 August 12 (UT 7^h13^m) and August 17 (UT 8^h02^m), with a resolution of ~5 Å. A red scan was obtained on 1984 August 22 (UT 3^h48^m), also with a resolution of ~5 Å. The night sky has been subtracted from the data.

The blue spectral scans have properly calibrated wavelengths between λ4046 and λ5570 Å. The scan of August 12 shows the Balmer series, Fe II lines, and the Ca II H and K lines all in emission. No absorption features are present. However, absorption features are evident on the August 17 scan. Also, on this second scan the Ca II K and Fe II emission lines are weaker compared to the Balmer series. Table I lists the measured lines together with their velocities, corrected to the sun. Figure 1 is a plot of the August 17 scan. The Hβ peak is at ~16500 counts.

TABLE I

MEASURED LINES AND RADIAL VELOCITIES

λ(lab)	Ion (mult)	August 12		August 17	
		λ(obs)	v(km/s)	λ(obs)	v(km/s)
4101.737	Hδ	4099.01	−206	4099.21	−193
4173.450	Fe II (27)	4172.17	−99	4173.77	+14
4233.167	Fe II (27)	4230.71	−181	4231.11	−155
4340.468	Hγ	4340.34	−16	4341.79	+82
4861.332	Hβ	4859.40	−126	4861.56	+5
4923.921	Fe II (42)	4921.69	−143	4923.88	−11
5018.434	Fe II (42)	5015.78	−166	5016.71	−112
5169.030	Fe II (42)	5166.53	−152	5167.26	−112
5234.620	Fe II (49)	5230.44	−247	5231.42	−192
5275.994	Fe II (49)	5273.13	−170	5275.10	−60
5316.693	Fe II (48,49)	5313.56	−184	5314.31	−143

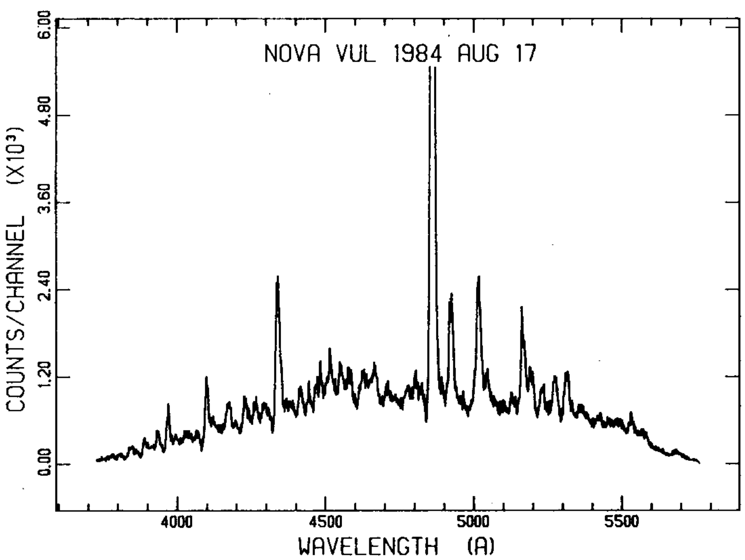

FIGURE 1

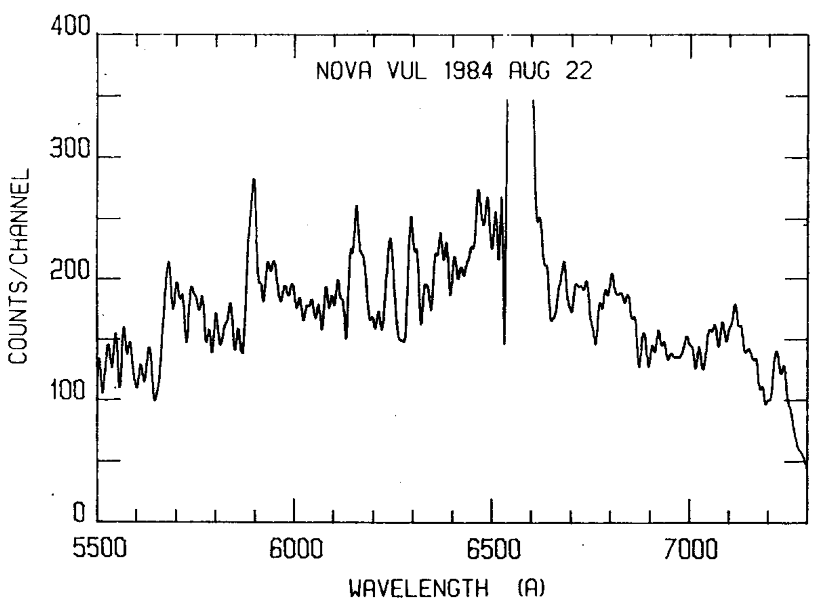

FIGURE 2

The red spectral scan has properly calibrated wavelengths between $\lambda5852$ and $\lambda7400$ Å. This spectral scan shows a strong $H\alpha$ in emission along with a very small, violet absorption feature. The full width of $H\alpha$ extends from $\lambda6538$ to $\lambda6605$ Å (-1151 to +1911 km/s). Other emission and absorption lines are present, but firm identifications could not be easily made. Figure 2 is a Fourier-smoothed plot of the August 22 scan. The $H\alpha$ peak is at ~6500 counts.

Various observers have reported visual estimates of the apparent magnitude of Nova Vul 1984 No. 1 to the IAU Circulars. A plot of the values from IAU Circulars Nos. 3963, 3964, 3968, 3969, 3971, and 3977 shows that the nova reached a peak brightness of $\sim6^{m}.3$ on August 4 and then fell to $\sim8^{m}.3$ on August 9. No further observations were reported until August 16 ($\sim8^{m}.5$). Therefore, for both blue observations the apparent visual magnitude was about $8^{m}.5$. By the time of the red observation, the nova had fallen to $\sim7^{m}.8$ from a second luminosity peak ($\sim7^{m}.3$) on August 19.

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